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A REVISION OF THE GENUS *EPHEMERELLA* (Ephemeroptera: Ephemerellidae) III. The Subgenus *Attenuatella*

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Salt Lake City, Utah

Introduction

Part I of this revision, the Subgenus *Timpanoga,* appeared in The Canadian Entomologist (1959: 51-58, 16 Figs.). Part II, the Subgenus *Caudatella,* is in press in the Annals of the Entomological Society of America. In the following species accounts collecions made by the authors are indicated by initials, GFE and/or RKA. Abbreviations for collections in which specimens are deposited are as follows: Canadian National Collection (CNC); University of California (UC); Illinois Natural History Survey (INHS); Oregon State College (OSC); personal collections of Dr. Velma K. Mayo (VKM) and Dr. J. R. Traver (JRT). Specimens without designation are desposited in the collection of the University of Utah.

Subgenus *Attenuatella* Edmunds

Traver. 1935. Biol. Mayflies, 566 (*attenuata*-group).
Edmunds. 1959. Ann. Ent. Soc. Amer., 52:546, 1 fig.

Until recently there has been considerable confusion as to the characterization of the mayfly groups recently named by Edmunds (1959) as the subgenera *Attenuatella* and *Dannella.*

In 1931 McDunnough made note of the similarities existing in the nymphal stages of *Ephemerella simplex* McDunnough, *E. attenuata* McDunnough and *E. margarita* Needham and placed these species in close alliance. Traver (1935) in treating the genus *Ephemerella* placed the adults of *E. simplex* and *E. attenuata* into separate groups, the *simplex*-group and the *attenuata*-group respectively, but placed the nymphal stages of *E. simplex, E. margarita,* and *E. attenuata* all in the *simplex*-group.

Traver *(op. cit.),* in her key to the nymphal stages, used the presence or absence of rudimentary gills on segment one to separate the species she placed in the *simplex*-group (=subgenus *Dannella*) from those she placed in the *bicolor*-group (=subgenus *Eurylophella*). Actually, all of the species of both subgenera, with the exception of *E. delantala* Mayo, may have rudimentary gills on segment one. The vestigial gill may be present on one side of the abdomen and missing on the other side of a single specimen. It is not known whether the missing gill has been broken off or does not develop.

[1] The research on which this report is based was supported by grants from the University of Utah Research Fund and the National Science Foundation (NSF G 2514, 4995, 13329).

The subgenus *Attenuatella* may be characterized in the male adult by the following characters: (1) the terminal segment of the genital forceps is five to six times as long as wide (Fig. 3); (2) the penes are long, narrow, and swollen apically (Fig. 3); and (3) the tibia of the foreleg is longer than the tarsus.

The nymphal stages are characterized by having (1) gills on abdominal segments 4-7 and rudimentary gills usually present on segment one, (2) abdominal segments eight and nine subequal, and (3) tarsal claws with denticles.

The subgenus *Attenuatella* is comprised of four species, *Ephemerella attenuata* McDunnough (=*E. hirsuta* Berner, 1946:70, *new synonymy*), *E. delantala* Mayo, *E. margarita* Needham, and *E. soquele* Day.[2]

Ephemerella hirsuta was described from two nymphs collected in Escambia County, Alabama. Berner *(op. cit.)* named these as new on the basis of the broad discontinuity of distribution with *E. attenuata* and the banding on the legs, which differed from McDunnough's (1931) description of the nymphs of *E. attenuata.* A comparison of several nymphs and one male adult of *E. hirsuta* with some of McDunnough's material of *E. attenuata* from the Canadian National Collection, shows that *"E. hirsuta"* fits well within the limits of variability of *E. attenuata.* Additional collections of *E. attenuata* have largely bridged the distributional gap (15b).[3] It is apparent that *E. hirsuta* is a synonym of *E. attenuata.*

The following keys will serve to distinguish the species of the subgenus *Attenuatella.*

MALE IMAGOES

1. Apex of penes with a V-shaped median notch; lateral margin of penes base forms a gently arching concavity (Fig. 3) ..... *attenuata*
   Apex of penes with a U-shaped median notch; lateral margin of penes base forms a sharply angled concavity (Fig. 4) ..... *margarita*

NYMPHS

1. Paired abdominal tubercles on terga 4-8 well developed and blunt giving posterior margin of each tergum a scalloped effect (Fig. 13); prothorax without paired submedian tubercles or protuberances. .... *delantala*
   Paired abdominal tubercles on terga 4-8 not as above; prothorax with paired submedian tubercles or protuberances 2
2. Paired abdominal tubercles on terga 4-8 well developed and sharp (Fig. 11) ..... *soquele*

---

[2] In 1952, Dr. Herman Spieth allowed the junior author to examine an adult male of an undescribed species of *Attenuatella* from China in the American Museum of Natural History. We were unable to locate the specimen in a 1960 visit to the museum.

[3] The collection localities from South Carolina, Georgia, Alabama and Florida indicated on the map are based on unpublished data made available by Dr. Lewis Berner.

Paired abdominal tubercles on terga 4-8 short and blunt (Figs. 1 and 12) 3

3. Prothorax with well developed paired submedian tubercles (Fig. 1); female with paired occipital tubercles (Fig. 2), male variable; lateral margins of all abdominal sterna pale ..... *attenuata*
Prothorax with only small paired submedian protuberances; without paired occipital tubercles; lateral margins of abdominal sterna 4-9 pale, each with a brown transverse band ..... *margarita*

Ephemerella attenuata McDunnough

McDunnough. 1925. Canad. Ent., 57:42.
McDunnough. 1930. Canad. Ent., 62:55.
McDunnough. 1931. Canad. Ent., 63:209, 2 figs. (nymph).
Traver. 1935. Biol. Mayflies, 581, 1 fig.
Berner. 1946. Florida Ent., 28:70 *(hirsuta)*.
Berner. 1950. Univ. Florida Studies, Biol. Sci. Ser., 4: 153, 156, 165, 1 map *(hirsuta)*.
Burks. 1953. Bull. Illinois Nat. Hist. Surv., 26 (1):75, 1 fig.
Edmunds. 1953. Ann. Ent. Soc. Amer., 52: fig. 1.

Male Imago. Length: body 6 mm. forewing 6 mm. General color dark brown. Legs pale yellowish white, forelegs darker; wing and veins hyaline. Abdominal segments dark brown, posterior three segments paler in color. Apex of penes with a V-shaped median notch; lateral margin of penes base gently arched (Fig. 3). Caudal filaments pale with a median brown transverse band.

Female Imago. General color more ruddy brown than male. Head with paired submedian tubercles behind ocelli, and a similar pair, wider apart, on the occiput. Other characters similar to the male except for usual sexual differences.

Mature Nymph. Length: body 6-7 mm.; caudal filaments 2-3 mm. General color light brown. Female with occipital tubercles (Fig. 2), male with or without. Prothorax with well-developed submedian tubercles; mesothorax with a low median anterior and a higher posterior tubercle (Fig. 1); legs pale, femur, tibia and tarsus each with a variable brown transverse band. Abdomen with paired dorsal submedian tubercles on segments 3-8, most distinct on segments 4-7, hind margins of segments 1, 2, and 9 sinuate; distinct postero-lateral projections on segments 3-9 (Fig. 1); lateral margins of abdominal sterna pale. Caudal filaments pale to brown, when pale variable brown bands are present; basal segments with short spines, apical segments with long hair.

Type Locality. Ottawa Golf Club (near Hull), Quebec, Canada.

Type. No. 1277, Canadian National Collection, Ottawa, Canada.

DISTRIBUTION

Ephemerella attenuata is a boreal eastern North American species with a wide latitudinal distribution (Fig. 15b). It is known from Nova Scotia, New Brunswick and Quebec austrad to Alabama and northern Florida. The authors have examined specimens from the following localities.

Florida. Holmes Co., Sandy Creek, I-V-46, L. Berner. *Georgia.* Macon Co., First creek W. Flint River on Ga. Highway 26, 11-IV-54, C. D. Hynes and L. Berner. *Massachusetts.* Berkshire Co., Sheffield, 28-VI-10, A. H. Morgan (JRT). *New Brunswick.* Cocagne River nr. Notre Dame, 17-VII-50, E. L. Bousefield; N. W. Miramichi River, 13-VIII-51, E. L. Bousefield; Louisberg Station, 4-VII-50, E. L. Bousefield. *Pennsylvania.* Lackawana Co., Scranton, VII-45, "Townes" (JRT). *Quebec.* Trinity Bay, 17-VIII-29, W. J. Brown (CNC); Ottawa Golf Club nr. Hull, 22-VII-25, F. P. Ide (CNC); LaPrairie, 21-VII-25, F. P. Ide (CNC); Knowlton, 9-VII-29; G. S. Walley (CNC); Yamaska River, Foster Power Plant, 5-VII-29, J. McDunnough (CNC). *South Carolina.* Edgefield Co., Log Creek at Highway 25, 0.9 mi. S. Turkey Creek, 18-IV-55, C. D. Hynes and L. Berner. *Virginia.* Clark Co., Shenandoah River, Berryville, 12-V-38, E. Surber (JRT).[4]

TAXONOMY

The adult stages of *E. attenuata* are easily distinguished from the adults of the other known species in the subgenus, and the morphological variability in this stage is at a minimum. The nymphal stage, on the other hand, is variable in morphological and color characters.

The general color of the nymph varies from light to dark brown, and some specimens are speckled with pale dots. Most nymphs possess a subapical brown band on the femora; however, this band may be continuous or interrupted, and some specimens may also have an additional interrupted femoral band near the middle. The pale margins of all abdominal sterna is a constant color character.

The paired dorsal abdominal tubercles are variable in sharpness and the degree of development. Most nymphs have discernible tubercles on segments 3-8, while the posterior margins of segments 1, 2, and 9 are only sinuate (Fig. 1). However, an occasional specimen will exhibit small tubercles on segments 1, 2, and 9, while in other specimens the posterior margins of segments 1, 2, 3, and 9 are only sinuate. The tubercles on segments 4-7 are always present, although in some nymphs they are better developed than in others.

Ephemerella delantala Mayo

Mayo. 1952. Pan-Pac. Ent., 28:94, 1 fig.
Day. 1956. Aquatic Insects Calif., p. 98.
Allen and Edmunds. 1956. Proc. Utah Acad. Sci., Arts and Letters, 33:87.

[4] Since this manuscript was submitted, RKA has been able to examine specimens of *Ephemerella attenuata* McDunnough from eight new localities, some of which are new state records and represent considerable range extensions. The records are as follows: *Indiana.* Pigeon River, Scott, 1-IV-28, H. T. Spieth (AMNH); Trib. Pigeon River, Mongo, 17-VII-29, H. T. Speith (AMNH); Pigeon River, Howe, 26-VI-29, H. T. Spieth (AMNH). *Michigan.* St. Joseph River, Tekonsha, 8-VII-29, H. T. Spieth (AMNH); So. Chippewa River, Mt. Pleasant, 28-VII-29, H. T. Spieth (AMNH). *New York.* East Islip, 6-VII-30, H. T. Spieth (AMNH). *North Carolina.* Jefferson, 4-VII-30, H. T. Spieth (AMNH).

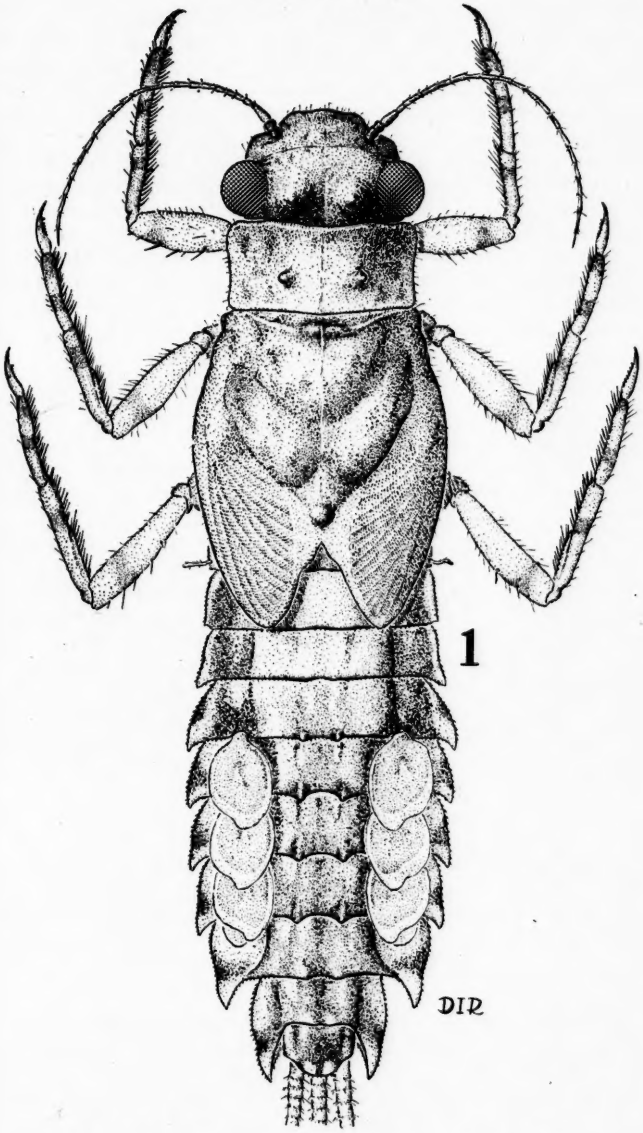


FIG. 1. *Ephemerella attenuata*, mature female nymph, dorsal view.

Ephemerella delantala is known only in the nymphal stage.

Mature Nymph. Length: body 5-6 mm.; caudal filaments 2.5-3 mm. General color yellow with brown markings. Head and thorax without tubercles; legs pale, coxae, trochanters, and basal half of femora brown, tibiae and tarsi with variable smoky transverse bands. Abdomen with paired dorsal submedian tubercles on segments 2-9, tubercles on segments 4-8 well-developed and blunt giving the posterior margins of these terga a scalloped effect (Fig. 13); distinct postero-lateral projections on segments 5-8 which curve upward forming a trough between the lateral margins and the abdominal tubercles; abdominal terga 5-7 pale, parts of terga 4 and 8 often pale; lateral margins of abdominal sterna 5-7 pale. Cavdal filaments usually pale, often with pale smoky basal annulations; basal segments without spines, apical segments with long hair.

Type Locality. Martis Creek near Truckee (6,000 ft.), Placer Co., California.

Type. California Academy of Sciences, San Francisco, California.

DISTRIBUTION

This western species is known only from California, Oregon and Washington (Fig. 15a). The authors have examined specimens from the following localities:

California. Tehama Co., Mill Creek, 5 mi. N. Childs Meadows, 3-VII-59, RKA; Placer Co., Martis Creek nr. Truckee (6,000 ft.), 23-VI-33, P. R. Needham (PARATYPE) (VKM); Mono Co., Green Creek, 6-VIII-52, W. C. Day; Nevada Co., Truckee River on Highway 40, at first crossing E. Donner Summit, 2-VIII-52, R. B. Selander. *Oregon.* Benton Co., Rock Creek, 10-V-41, H. E. Mastin; Corvallis, 29-III-39, "Polson"; Lincoln Co., Five Rivers Area at Maple Camp, 11-V-40, H. N. Walwyn; Yew Creek, 6-IV-40, "Pitney" (OSC); Greasy Creek, 10-V-41, H. E. Mastin (OSC); Mill Creek, 4-V-40, H. N. Walwyn (OSC); Lane Co., McKenzie River, Oregon Highway 126, 15-VI-58, M. L. Johnson. *Washington.* Yakima Co., Naches River, 1 mi. S. Cliffdell, 5-IX-58, GFE and RKA.

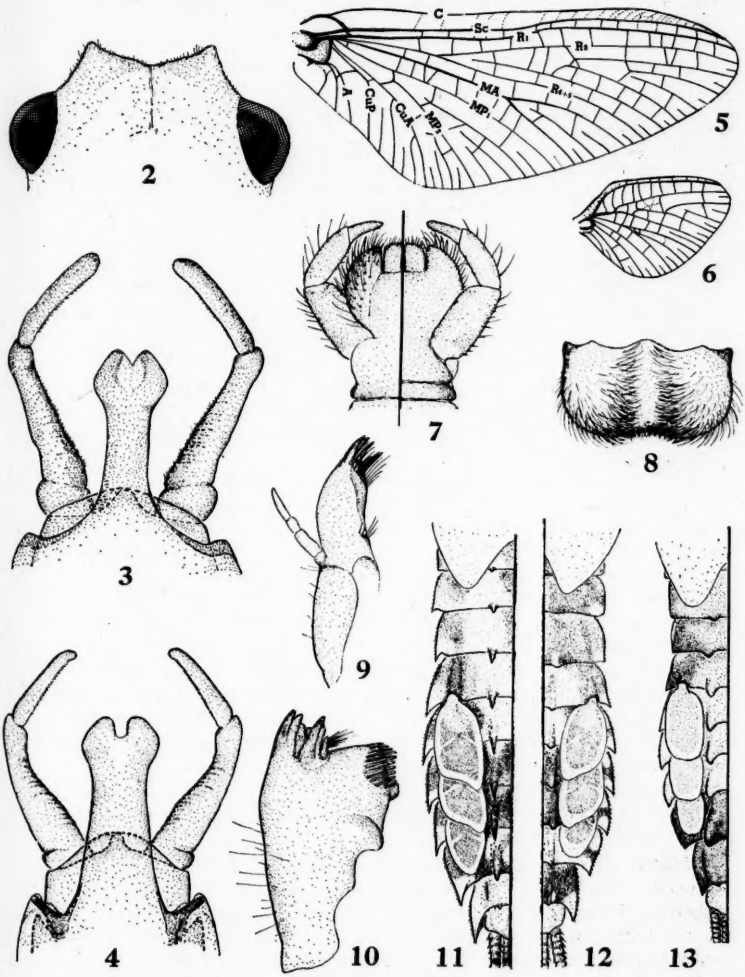
BIOLOGY

This species inhabits clear or lightly silted, rather cool (50-56° F.) moderately flowing streams with rocky bottoms. It is found in the slower moving waters near the shore where it often occurs with *Ephemerella hecuba* Eaton and *E. tibialis* McDunnough.

TAXONOMY

Ephemerella delantala is the only species in the subgenus *Attenuatella* in which a rudimentary gill has not been found on the first abdominal segment of the nymph.

The morphological and color variation is at a minimum in this species. The paired dorsal abdominal tubercles on segments 2 and 9 are found to vary in degree of development and sharpness, but are always discernible.



FIGS. 2-3. *Ephemerella attenuata*. Fig. 2, vertex of head, front view; Fig. 3, male genitalia, dorsal view. FIGS. 4-6. *E. margarita*. Fig. 4, male genitalia, dorsal view; Fig. 5, forewing of male imago; Fig. 6, hindwing of male imago. FIGS. 7-10. *E. attenuata*, nymphal mouthparts. Fig. 7, labium; Fig. 8, labrum; Fig. 9, maxilla; Fig. 10, left mandible. FIGS. 11-13. Subgenus *Attenuatella*, half of abdominal terga of mature nymph. Fig. 11, *E. soquele;* Fig. 12, *E. margarita;* Fig. 13, *E. delantala*.

Terga 4-6 are always pale in color, while the pale markings on terga 3 and 7 vary from specimen to specimen.

Ephemerella margarita Needham

Needham. 1927. Ann. Ent. Soc. Amer., 20:114.
Needham and Christenson. 1927. Utah Agric. Exp. Sta. Bull., 201:9, 1 fig.
Walley. 1930. Canad. Ent., 62:14, 4 figs.
McDunnough. 1931. Canad. Ent., 63:210, 1 fig.
Traver, 1935. Biol. Mayflies, 611.
Edmunds. 1954. Proc. Utah Acad. Sci., Arts and Letters, 31:66.
Allen and Edmunds. 1956. Proc. Utah Acad. Sci., Arts and Letters, 33:87.

Needham (1927) named this species from nymphs collected at several localities in Utah, and Traver (1935) designated a specimen from the Provo River as the lectotype.

McDunnough (1931) tentatively associated imagoes collected in Alberta as the adults of this species. The authors were able to examine these specimens, plus others collected in British Columbia, Wyoming and Montana, and believe McDunnough to be correct in this association. We base this conclusion on subgeneric characters found in the male imago, and *E. margarita* is the only known species of this subgenus which is known to occur in these areas.

McDunnough *(op. cit.)* reported nymphs collected in New Hampshire as *E. margarita* and stated that he could find no morphological difference between these specimens and the western form. The authors have examined material from New Brunswick and Nova Scotia and have also found these widely separated forms to be morphologically the same.

Male Imago. Length: body 6 mm.; forewing 6 mm. Head and antennae dark brown; upper portion of eye orange, lower portion gray. Thorax dark brown; antero-lateral margin paler; sutures pale; legs brown, forelegs darker than middle and hind legs; wings hyaline, costal, subcostal and radial veins light brown, other veins and crossveins pale. Abdomen almost uniformly light brown; segments 1-7 semi-hyaline; 8-10 opaque. Apex of penes with a U-shaped notch; lateral margin of penes base forms a sharply angled concavity as in Fig. 4.

Female Imago. General color similar to that of male, except thorax and legs lighter brown. Other characters similar to those of male except for usual sexual differences.

Mature Nymph. Length: body 6-9.5 mm.; caudal filaments 2-3 mm. General color brown with darker brown markings. Without occipital tubercles. Prothorax with small paired submedian protuberances; mesothorax with small median anterior and posterior protuberances; legs pale with brown transverse bands. Abdomen with paired dorsal submedian tubercles on segments 3-9; distinct postero-lateral projections on segments 4-8 (Fig. 12); abdominal terga brown with part or all of some terga pale; sterna 4-9 with pale lateral margins interrupted by a brown transverse band. Caudal filaments with a brown transverse band near the middle; basal segments with spines, apical segments with long hair.

Type Locality. Provo River, Utah.

Type. Cornell University, Ithaca, New York.

DISTRIBUTION

Ephemerella margarita is a boreal species with two separate populations, one western and one eastern. It appears that this is a monotypic species and future collections may fill in this distributional gap. The eastern population is known from New Brunswick, Nova Scotia and New Hampshire

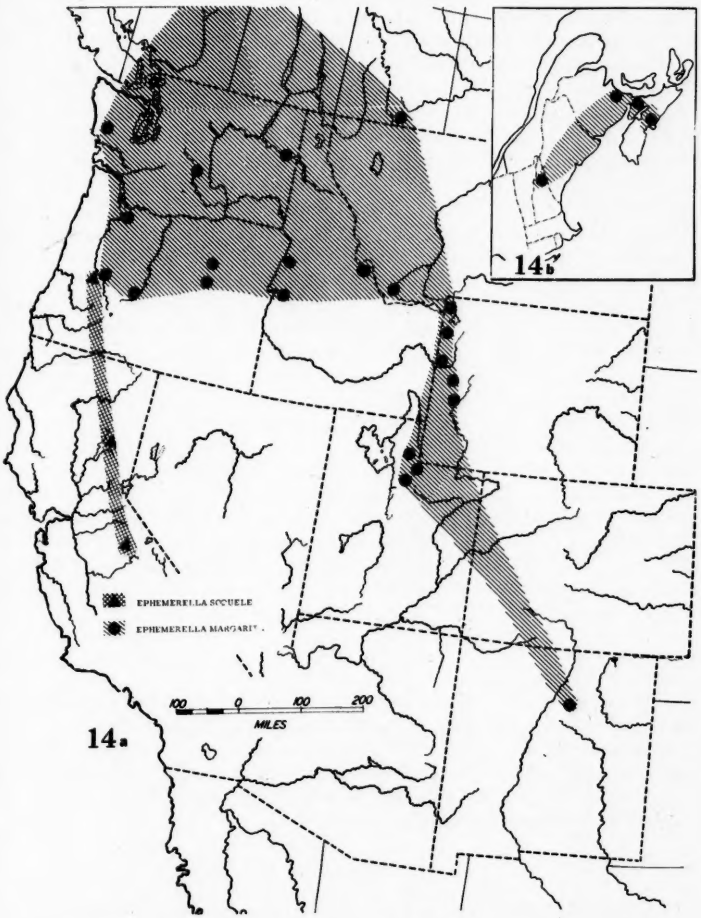


FIG. 14a. Distribution map of *Ephemerella soquele*, and the western population of *E. margarita*. FIG. 14b. Distribution map of the eastern population of *E. margarita*.

(Fig. 14b). The western population is known from British Columbia and Alberta austrad to Utah and New Mexico (Fig. 14a). The authors have examined specimens from the following localities:

Alberta. Old Man River, Lundbreck, 7-VII-30, J. H. Pepper (CNC). *Idaho.* Idaho Co., Rapid River at Jct. with Little Salmon River, 5 mi. N. Pollock, 6-IX-58, GFE and RKA; Biose Co., Payette River, 5 mi. W. Crouch, 6-IX-58, GFE and RKA; Lemhi Co., Middle Fork Salmon River, North Fork, 2-VIII-58, GFE. *Montana.* Beaverhead Co., Dillon, 3-VIII-47, F. C. Harmston; Gallatin Co., Rocky Creek, Bozeman, 10-VIII-28, J. McDunnough (CNC). *New Brunswick.* Stream nr. Salem, 9-VII-50, E. L. Bousefield; Cocagne River nr. Notre Dame, 17-VII-51, E. L. Bousefield. *New Mexico.* San Miguel Co., Pecos River, 10 mi. above Pecos, 30-VII-43 (JRT). *Nova Scotia.* Margaree River, Cape Breton Island, 6-VII-50, E. L. Bousefield; Stream nr. Brooklyn, 22-VI-50, E. L. Bousefield. *Oregon.* Grant Co., Canyon Creek, 5 mi. S. Canyon City, 21-VIII-54, GFE and RKA; Silvies River nr. Bear Valley Rangers Station, 21-VIII-54, GFE and RKA; Klamath Co., Little Deschutes River, Crescent, 23-VIII-54, GFE and RKA; Clackamas Co., Mollala River, 3 mi. E. Mollala, 26-VIII-54, GFE and RKA; Lane Co., VII-57, M. L. Johnson. *Utah.* Duchesne Co., Bridgeland, 22-VII-42, GFE; Duchesne River, 15 mi. N. Duchesne, 20-VII-47, GFE; Summit Co., Weber River at Glendale Ranch, 19-VIII-45, S. Mulaik and GFE. *Washington.* Spokane Co., Little Spokane River, Milan, 26-VI-55, RKA; Yakima Co., Naches River, 1 mi. S. Cliffdell, 5-IX-58, GFE and RKA; Grays Harbor Co., Humptulips River at Humptulips, 2-IX-58, GFE and RKA. *Wyoming.* Lincoln Co., Salt River, 9 mi. N. Afton, 18-VIII-59, GFE and W. L. Peters; Snake River, 7 mi. E. Alpine, 8-IX-57, GFE; Teton Co., Snake River, Hoback, 18-VIII-59, GFE and W. L. Peters; Snake River, 1 mi. S. entrance to Yellowstone National Park, 18-VIII-59, GFE and W. L. Peters; Stream at Jenny Lake, 22-VIII-48, D. G. Denning; Sublette Co., Big Piney, 9-VIII-49, H. Higgins; Green River nr. Daniel, 13-VIII-40, T. H. Frison and T. H. Frison, Jr. (INHS); Yellowstone National Park, Madison River, 3 mi. W. Madison Jct., 10-VII-50, GFE; Firehole River, Upper Geyser Basin, 22-VII-28, J. McDunnough (CNC).

BIOLOGY

This species is commonly found at the margins of rather large sluggish rivers; however, the authors have also collected nymphs in small and medium sized, moderately flowing streams. Specimens collected in Oregon were all from about 3,000 feet elevation, while in Utah, collection records are from 5,500 to 7,500 feet. Adults which have been determined as this species were collected from July to late August.

TAXONOMY

Ephemerella margarita nymphs vary in the degree of development and sharpness of the paired dorsal abdominal tubercles and in the dorsal abdominal color pattern.

The abdominal tubercles on segments 4-9 may vary slightly in degree

of development and sharpness. Tubercles may be present on segments 2 and 3, but in many specimens discernible tubercles are wanting and the posterior margins of these segments are only sinuate. The abdominal terga are brown with part or all of some terga pale. Terga 5; 5 and 8; 5, 8, and 10; or 5, 8, 10 and 4 may be pale in these combinations. The eastern specimens of *E. margarita* all have a pale mesonotum with two dark dots. This color pattern is found only rarely in western specimens.

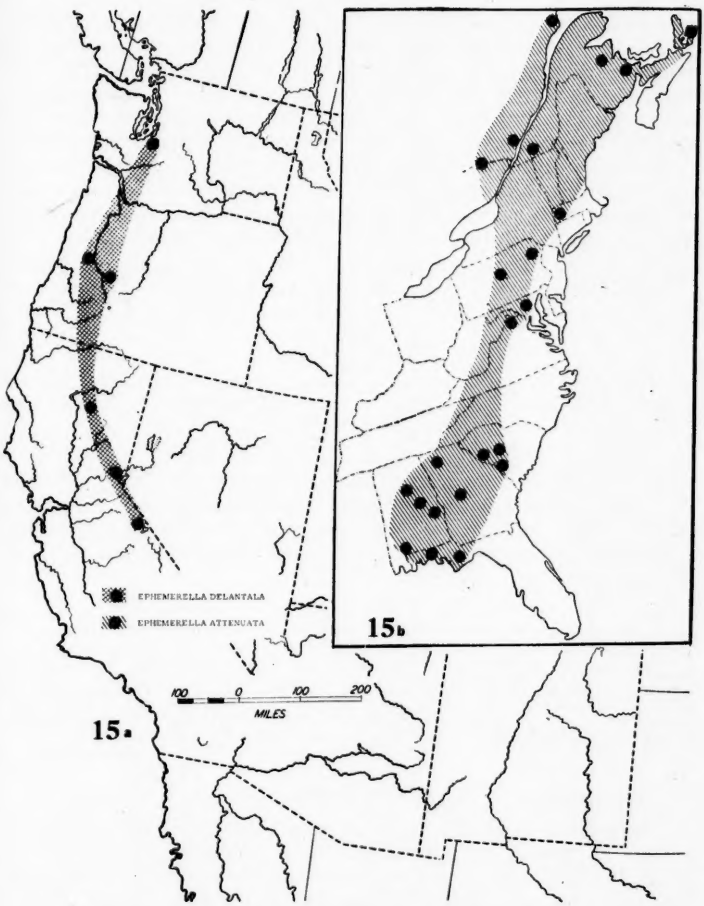


FIG. 15a. Distribution map of *Ephemerella delantala*.
FIG. 15b. Distribution map of *E. attenuata*.

Ephemerella soquele Day

Day. 1954. Pan-Pac. Ent., 30:18, 2 figs.
Day. 1956. Aquatic Insects Calif., p. 98.

Ephemerella soquele is known from nymphs only. Day (1954) reported this species to have paired dorsal abdominal tubercles on segments 2-9. The authors in examining seven paratypes found one of these specimens to bear paired dorsal tubercles on segment one. One other specimen had a tubercle on one side of this segment and not on the other.

Mature Nymph. Length: body 7.5-8 mm.; caudal filaments 3.5 mm. General color brown with pale markings. Without occipital tubercles. Prothorax with paired submedian tubercles; mesothorax with a low anterior and a higher posterior tubercle; legs pale with brown transverse bands. Abdomen with paired dorsal submedian tubercles on segments 1-9 or 2-9; tubercles on segment one, when present, are small; distinct postero-lateral projections on segments 2-9 (Fig. 11); abdominal terga brown, parts of terga 3-5 usually pale; lateral margins of abdominal sterna 4-9 with a pale area. Caudal filaments with brown transverse annulations and with brown tips; basal segments with short spines, apical segments with long hair.

Type Locality. Soquel Meadow, Willow Creek, Madera Co., California.
Type. California Academy of Sciences, San Francisco, California.

DISTRIBUTION

This species is known from the Cascade Mountains of central Oregon to the Sierra Nevada Mountains of central California (Fig. 14a). The authors have examined specimens from the following localities:

California. Madera Co., Soquel Meadow, Willow Creek, 14-VII-51, Helen L. and W. C. Day (PARATYPES); Soquel Public Camp, 14-VII-51, W. C. Day; Pichon ? Meadows, Sierra Nevada Mountains, C. D. Michener (JRT); Plumas Co., North Fork Deer Creek, 12 mi. N. Quincy Jct., 3-VII-59, RKA. *Oregon.* Lane Co., Willamette River nr. Walker, 26-VI-57, M. L. Johnson.

TAXONOMY

The nymph of *E. soquele* varies in the number and the degree of development of the paired dorsal abdominal tubercles. Paratypes were found to possess tubercles on terga 1-9 or 2-9. These tubercles also vary slightly in degree of development, especially those on terga 2 and 3.

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Dr. Lewis Berner of the University of Florida for the gift of valuable specimens, for making available his records from the Southeastern United States, and for helpful suggestions. We are grateful also to E. L. Bousefield, Donald G. Denning, Harold Higgins and M. L. Johnson for the gift of valuable specimens. We are indebted to Mr. David I. Rasmussen and Mr. Steve L. Jensen who prepared most of the figures included in this report.

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A NEW SPECIES OF *TENAGOGONUS* FROM THE FIJI ISLANDS[1] (Gerridae: Heteroptera)

HERBERT B. HUNGERFORD AND RYUICHI MATSUDA

In our key to the *Tenagogonus-Limnometra complex* of the Gerridae [Univ. Kansas Sci. Bull. 39(9):377-378, 1958] this new species runs to *T. fijiensis* Hungerford and Matsuda, but is not that species.

Tenagogonus valentinei n. sp.

Size: Apterous male: 5.7 mm. long; width across mesoacetabula 2.14 mm.; width across head 1.4 mm. Apterous female: 6.93 to 7.89 mm. long; width across mesoacetabula 2.52 to 2.73 mm.; width across head 1.47 to 1.68 mm.

Color: Color pattern of head and thorax about the same as in *T. fijiensis* but general facies darker. Median longitudinal and marginal bands black and broader than in *T. fijiensis*. Metanotum mostly black. First abdominal tergite black with lateral margin yellow in both sexes; second to seventh tergites light brown with black lateral margin in male, and nearly totally black and frosted by gray in female. Connexivum with a median longitudinal dark band in both sexes. Antennae and legs mostly brown. Venter yellow.

Structural characteristics: Proportional lengths of antennal segments, 1st:2nd:3rd:4th::99:67:62:? in male, and 95:68:60:75 in female. Total length of female antenna a little shorter than length of body (6.26 mm. versus 6.93 mm. in one specimen). Beak relatively longer than in *T.*

[1] Contribution No. 1098 from the Department of Entomology, The University of Kansas. This report is a by-product of a project conducted by the aid of a grant from the National Science Foundation.

fijiensis, its third segment plainly surpassing front coxae. Front leg stout, its femur thicker than middle femur.

Relative lengths of leg segments in male holotype:

	Femur	Tibia	First tarsal segment	Second tarsal segment
Front leg	120	110	12	20
Middle leg	305	275	90	23
Hind leg	330	190	30	16

Pronotum of apterous form sharply dilated at apical one fifth; caudal margin broadly truncate. Connexivum nearly erect and without spine apically in male; erect on basal segments and reflexed on distal segments,

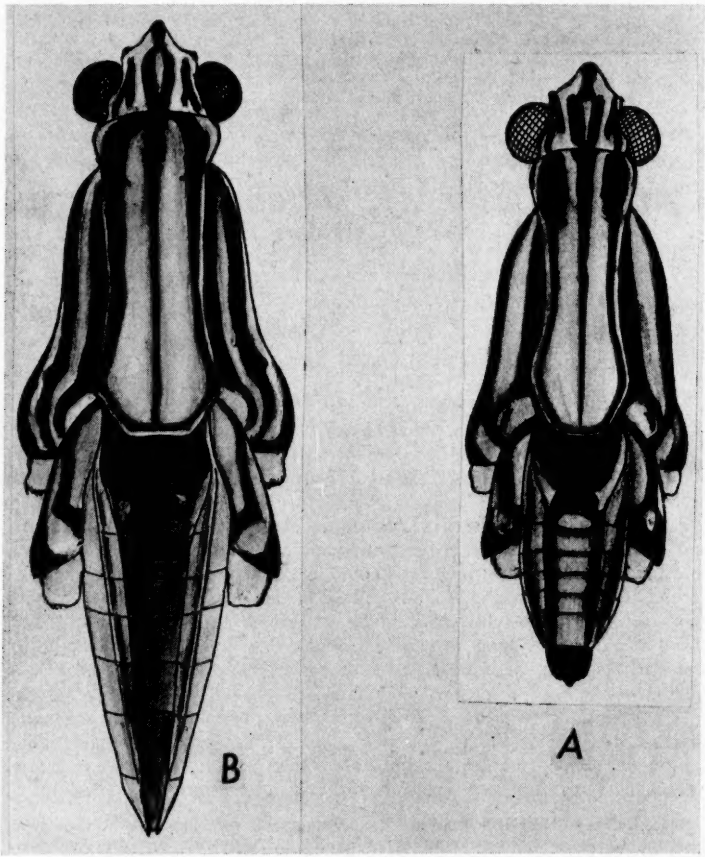


FIG. 1. *Tenagogonus valentinei* Hungerford and Matsuda. A. male, B. female.

often meeting over last tergite, and caudal spine conspicuous in female as shown in text figure 2 B. Abdominal tergites of male short except first and seventh, seventh tergite a little shorter than two preceding segments together and than eighth tergite. Ventrally hind coxae surpass rear margin of fourth abdominal segment in male, reaching or slightly surpassing rear margin of second abdominal segment in female. Male ventral abdominal segments short except last one, which together with eighth and ninth segments is longer than all preceding segments together. Ventral surface of eighth abdominal segment (first genital) normal. Last ventral abdominal segment (seventh) of female not as long as three preceding segments together, ending in a mid-ventral point and tublar (text figure 2 B).

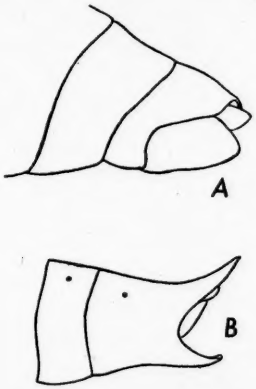


FIG. 2. *Tenagogonus valentinei* Hungerford and Matsuda in side view. A. Apical abdominal segments of male. B. Apical abdominal segments of female.

Comparative notes: This new species may be separated from *Tenagogonus fijiensis* as follows:

A. Pronotum of apterous form narrowed at caudal end in both sexes. Connexival caudal extensions of female broad, flap-shaped, may overlap each other ..... *T. fijiensis* Hungerford and Matsuda

AA. Pronotum of apterous form broad at lateral caudal angle in both sexes. Connexival caudal extensions of female broad at bases but pointed apically, tips rarely overlap. ..... *T. valentinei* Hungerford and Matsuda

T. fijiensis was described from Tavenui, a small island south east of Vanua Levu, while *T. valentinei* comes from Viti Levu, the largest island in the group. Both come from comparable elevations, the former from 2500 ft. and the latter from 2400 to 2700 ft.

Location of types: Male holotype and female allotype (Nandarivatu, Vitilevu, Fiji, October 1937, J. M. Valentine, coll.) and one female paratype (Waito Tailevu, Vitilevu, Fiji, August 23, 1937, J. M. Valentine, coll.) are

in the Bernice P. Bishop Museum, Honolulu, Hawaii; one female paratype (Nandarivatu, Vitilevu, Fiji, October 14, 1938, 2400 ft., E. C. Zimmerman, coll.), and another female paratype (Nandarivatu, Vitilevu, Fiji, September 7, 1938, 2700 ft., Y. Kondo, coll.) are in the Snow Entomological Museum, The University of Kansas.

A NEW CORIXID FROM GUATEMALA[1]

HERBERT B. HUNGERFORD AND RYUICHI MATSUDA

Sigara (Aphelosigara) cantralli n. sp.

Size: Length 4.62 mm.; width of head 1.47 mm.

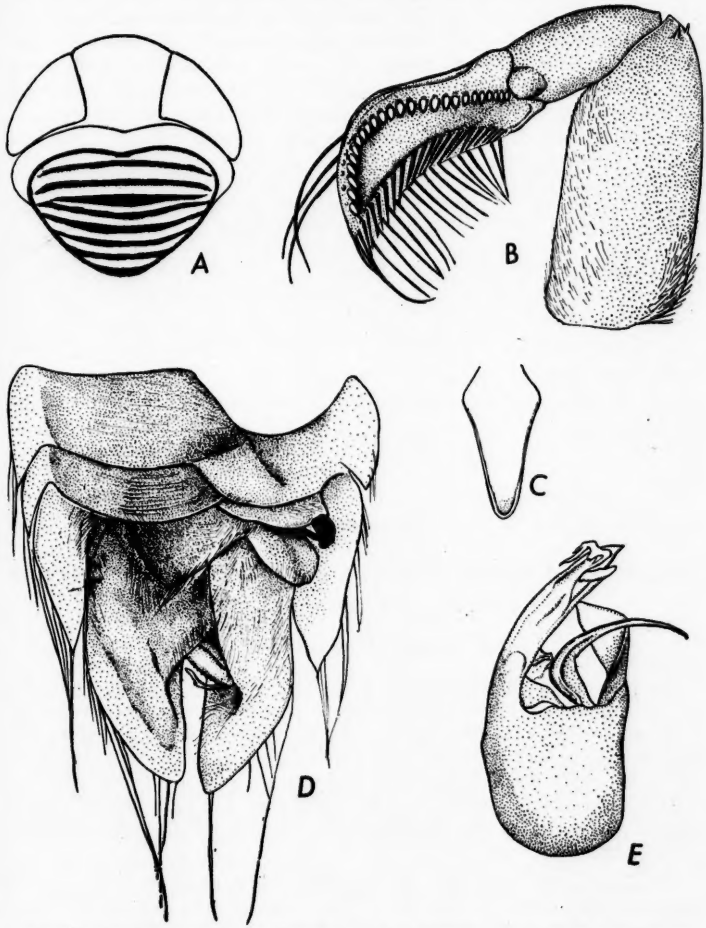
Color: General facies moderately dark. Vertex of head brownish yellow. Pronotal disk margined by a brown line, six or eight dark cross bands usually have their ends coalescing with marginal band and are slightly narrower than pale interspaces, third and fourth bands often coalesce at one or both ends. Hemelytral pattern darker and a little more distinct than in *S. (A.) jarmanae*. Clavus with basal dark bands that may be partly etched away; other cross veins may be broken, furcated, or anastomosing. Corium irregularly cross-banded, with many dark broken lines; overlapping membranes may show brownish mottlings, lower one almost transparent. Connexivum silvery white to frosty black. Venter of thorax and legs yellowish. Basal ventral abdominal segments of male dark brown.

Structural characteristics: Head about two thirds as long as pronotal disk; rear margin of head caudally produced at middle and carinate; interocular space narrower than width of an eye. Male facial fovea narrow, shallow, poorly defined, with a few scattered hairs. Proportional lengths of antennal segments, 1:2:3:4::20(?):13:32:20. Pronotum rastrate, disk not reaching as far laterally as patterned portion of clavus, with a median longitudinal carina on anterior third. Lateral lobe of prothorax elongate, sides nearly parallel, apex rounded. Hemelytra basally rugulose, with a few pale hairs. Mesoepimeron rather narrow, with osteole near apex. Metaxyphus long and narrow (Fig. C). Front leg of male (Fig. B) with pala cultrate, carinate on dorsal margin at base, pegs in a single curving row nearer dorsal margin than palm except at base and numbering about 25; tibia about five sevenths as long as pala, without a dorsal carina but with a distal pad covering base of pala; femur with inner basal half with long hairs on basal third of rear margin. Proportional lengths of leg segments as follows: middle leg, femur:tibia:tarsus:claws::260:135:85:135. Hind leg, femur:tibia:1st tarsal:2nd tarsal::148:140:170:80. Male asymmetry dextral; strigil of medium size, with three to five combs on a black obliquely directed stalk. Dorsal side of male abdomen as shown in Fig. D. Male genital capsule as shown in Fig. E. Right paramere has basal fourth broad,

[1] Contribution No. 1097 from the Department of Entomology, The University of Kansas. This report is a by-product of a project conducted with a grant from the National Science Foundation.

with what appears to be a ridge that extends onto slender distal three fourths of the paramere; left paramere has a number of short peg-like spines on its outer surface. Penal sheath terminating in curiously shaped flaps.

Comparative notes: This new species runs to the genus *Sigara* (p. 43) and to *Sigara (Aphelosigara) jarmanae* (pp. 610-612) in Hungerford's keys in "The Corixidae of the Western Hemisphere." It has similar modifica-



Sigara (Aphelosigara) cantralli Hungerford and Matsuda. A. Head and pronotum; B. Right front leg of male; C. Metaxyphus; D. Dorsal view of male abdomen; E. Genital capsule.

tions of the curiously shaped flaps on the penal sheath, and the pruinous area long the dorsal side of the claval suture is conspicuously longer than that on the ventral or corial side as it is in *Sigara jarmanae* Hungerford. These characters separate both of them from the five known species of *Pseudocorixa* which have similar general facies but are broader and more compact species with the head more than one third as wide as length of insect. To regard the specimens as *S. (A.) jarmanae,* however, would be misleading, for they are smaller, relatively more slender and darker in general facies than *S. (A.) jarmanae,* and the distal three fourths of the right paramere is relatively more slender and with a more conspicuous ridge on the basal half of the paramere. Therefore, until more specimens, including females, become available we are considering them as a new species of *Sigara (Aphelosigara)* and separate the two species as follows:

A. General facies lighter. Dark bands of pronotal disk plainly narrower than the pale bands. Body length over 5 mm. Width of head to length of body::100:308, thus a rather broad form. ..... *Sigara (Aphelosigara) jarmanae* Hungerford.

AA. General facies dark. Dark bands on pronotal disk not plainly narrower than the pale bands. Length of body less than 5 mm. Width of head to length of body::100:314, thus a more slender form. ..... *Sigara (Aphelosigara) cantralli* Hungerford and Matsuda

Location of types: Two males (holotype and one paratopotype, Tikal, at light at camp. Petén, Guatemala, Feb. 7, 1956, I. J. Cantrall) are in the Zoological Museum, The University of Michigan; two other male paratopotypes are in the Snow Entomological Museum, The University of Kansas.

A NEW PARASITIC GENUS OF CERATININI FROM AUSTRALIA[1] (Hymenoptera: Apoidea)

CHARLES D. MICHENER[2]

As indicated in a recent paper (Michener, 1961), the socially parasitic or "cuckoo" type of behavior seems to have arisen three times among the primitively social ceratinine bees of the *Allodape-Exoneura* complex. The parasitic forms have not been very successful in the sense that they have not given rise to large numbers of parasitic species such as are found in *Nomada* and other major parasitic genera of bees. They are also, in varying degrees, quite similar to their hosts, suggesting a relatively recent origin of the parasitic habit.

[1] Contribution No. 1104 from the Department of Entomology, The University of Kansas, Lawrence, Kansas.

[2] It is a pleasure to acknowledge facilities provided by the University of Queensland through the courtesy of Mr. F. A. Perkins, Reader in Entomology and head of the Department of Entomology of that institution. Studies in Australia were possible thanks to a research grant from the Fulbright program of the United States government.

The most distinctive of the parasitic Ceratinini is the South African genus *Eucondylops,* represented by a single species parasitic in nests of *Allodape* (Brauns, 1902). Among other characters, it differs from its hosts by the lack of the pollen collecting scopa and the lack of the second recurrent vein in the forewing. The Australian genus described below for what has been called *Exoneura excavata* Cockerell is also quite different from its pollen gathering relatives, *Exoneura,* as will be shown in detail. Finally, two closely related Australian species of *Allodapula* that are probably parasitic still retain the scopa and would not have been recognized as parasites except that one of them was found in nests of another species of *Allodapula* (Michener, 1961).

The desirability of placing the parasitic species *excavata* in a genus separate from *Exoneura* is open to question. From the standpoint of its phylogenetic origin, it is certainly close to *Exoneura* and must have arisen from the group of *E. hackeri* Cockerell, *insularis* Cockerell, and the host of *excavata,* as yet unidentified. The male alone would not be separated except as a species of this group and the larval characters agree with those of the group. The female, however, differs by such numerous and striking characters that a substantial amount of evolution must have occurred during the history of the parasite. It is for this reason that it is accorded generic status. A more objective decision as to its proper status as compared to other ceratinine genera can only be made when a numerical (statistical) taxonomic study of the tribe has been made. Present knowledge would seem to make generic and subgeneric ranking about equally logical.

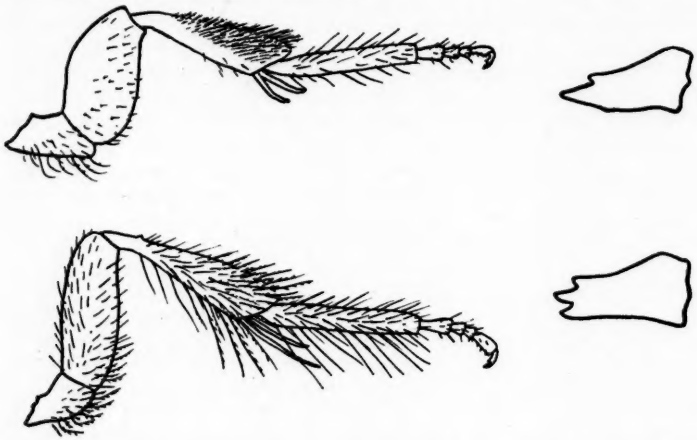
Inquilina new genus

Type species: *Exoneura excavata* Cockerell, 1922.

Social parasites closely allied to *Exoneura,* with which they agree in major features of body form, wing venation, genitalia, etc. The following characteristics of *Inquilina* do not distinguish it from *Exoneura* but are group characters in that genus: Subantennal sutures in both sexes (especially in the male) longer than diameter of antennal socket; head and thorax as well as antennal scape, coxae, trochanters, and femora of male with long, coarsely branched hairs; eyes of male dilated, separated by less than width of an eye; anterior tarsi of male attenuate, first two segments together longer than tibia; vein Cu_1 long and gradually tapering to become a brown streak.

The following features of *Inquilina* (female only except as otherwise indicated) distinguish the genus from *Exoneura:* Entire face broadly concave, depressions for accommodation of antennal scapes above antennal bases especially conspicuous; mandible with ventral tooth reduced to mere convexity, therefore bidentate instead of tridentate as in related genera; anterior margin of pronotum (both sexes) with sharp angle or tooth at level of lower margin of propleuron; legs, especially middle and hind femora and tibiae, very robust, hind femur only about twice as long as broad; middle and hind tibial spurs robust, less than half as long as basitarsi, strongly curved apically; area of basitibial plate largely bare and shining, plate delimited apically only by feeble ridge, often not evident,

always obscured by pubescence, elsewhere plate not margined in any way; tibial scopa reduced to short dense hairs, lengths less than tibial diameter; basitarsal scopa reduced to hairs which at longest are equal to basitarsal diameter; hind basitarsus as long as tibia.



Posterior legs and mandibles of females. Above, *Inquilina excavata* (Cockerell); below, *Exoneura hackeri* Cockerell.

Inquilina excavata (Cockerell)

Exoneura excavata Cockerell, 1922, Mem. Queensland Mus., 7:276.

Specimens of this species were found repeatedly in nests of an unidentified *Exoneura*. The *Exoneura* does not agree with any of the types which have been seen by me. As soon as I have examined Tarlton Rayment's types, I expect to identify or describe it, but for the present it must remain without a name. No specimens of *I. excavata* were taken by me on flowers, although the type was probably captured on flowers by Henry Hacker. Nests containing *I. excavata* were taken at three locations, all in Southern Queensland on the borders of rainforest patches. These localities are Tamborine Mountain, Cunningham's Gap, and Binna Burra near Lamington National Park. Dates of collection range from December 8, 1958, to February 25, 1959. The last mentioned locality is essentially the type locality; Hacker's labels, "National Park, Queensland," refer to the area now known as Lamington National Park.

Biological data on this species, its relations to the host, and its larval characters, will be presented elsewhere.

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Michener, Charles D. 1961. Probable parasitism among Australian bees of the genus Allodapula (Hymenoptera, Apoidea, Ceratinini), Ann. Ent. Soc. Amer., in press.

SYSTEMATICS OF THE CARPENTER BEE TYPES (GENUS *XYLOCOPA* LATREILLE) CONTAINED IN THE COLLECTIONS OF THE MUSEO ARGENTINO DE CIENCIAS NATURALES "BERNARDINO RIVADAVIA," BUENOS AIRES (Hymenoptera: Apoidea)

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In October of 1959, while attending the meetings of the Primero Congreso Sudamericano de Zoologia held at La Plata, Argentina, we had an opportunity to study the critical collections of carpenter bees (*Xylocopa*) contained in the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires. The successful execution of that investigation was greatly facilitated by Manuel José Viana, Director of the Department of Entomology. Not only did he place at our disposal the entire collection of carpenter bees including the type materials described and deposited there by Burmeister (1876) and Brèthes (1916, 1924), but he also generously assisted in the recording of distributional data. Without this help, our proposed studies could not have been completed in the limited time available to us.

Listed below are the names of the nine *Xylocopa* described from the material on deposit in that museum. A discussion of the taxonomic status of each is presented in the systematic accounts which follow. The results of other studies made by us, which have a bearing on the systematics of the Brèthes and Burmeister *Xylocopa* types, are freely incorporated.

Xylocopa bellula Brèthes, 1916
Xylocopa boliviana Brèthes, 1916
Xylocopa ciliata Burmeister, 1876
Xylocopa guaranitica Brèthes, 1916
Xylocopa nigrocincta var. *jujuyensis* Brèthes, 1916
Xylocopa martinezi Brèthes, 1924
Xylocopa augusti var. *pterochloris* Brèthes, 1916

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[1] Participation in the studies of the New World carpenter bees was made possible while serving as Research Scholar, "Fulbright Commission," and Fellow, John Simon Guggenheim Memorial Foundation, during 1959-60.

[2] The authors wish to acknowledge aid from the Campanha Nacional de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), Rio de Janeiro, the Conselho Nacional de Pesquisas (CNPq), Rio de Janeiro, and the Instituto de Pesquisas da Universidade do Paraná, Curitiba, Brasil.

[3] Studies of those type specimens of *Xylocopa* referred to in this investigation that are on deposit in the British Museum (Natural History), the Instituto Español de Entomologia, Museo de Ciencias Naturales, Madrid, the Muséum National d'Histoire Naturelle, Paris, and the Naturhistorisches Museum, Vienna, were made possible by aid received from the National Science Foundation through the University of Kansas, Lawrence.

Xylocopa rotundiscuta Brèthes, 1916
Xylocopa serripes Burmeister, 1876

Of these, all but *X. ciliata* Burmeister and *X. nigrocincta* var. *jujuyensis* Brèthes are synonyms of other species of *Xylocopa*. *X. serripes* Burmeister, although described from Rio de Janeiro, Brasil, is a synonym of the Old World *X. fenestrata* (Fabricius). The types, a male and female, probably were adventives at the time of their capture in Rio de Janeiro.

X. bellula Brèthes is a synonym of *X. bambusae* Schrottky, as is also *X. eburnea* Friese. *X. boliviana* Brèthes was described earlier as *X. tegulata* Friese. *X. guaranitica* Brèthes, *X. augusti* var. *pterochloris* Brèthes, and *X. ferruginea* Lepeletier (originally recorded from "Bengale") are synonyms of *X. augusti* Lepeletier. *X. rotundiscuta* Brèthes and *X. mendax* Maidl are synonyms of *X. simillima* Smith which until this study was known from "Hab. Australia." Finally, *X. martinezi* Brèthes and *X. alfkeni* Dusmet y Alonso are synonyms of *X. viridigastra* Lepeletier. It is suggested that *X. tricuspidifera* Kriechbaumer may also be a synonym of that species.

We are indebted to Dr. G. Steinbach, Zoologisches Museum, Humboldt-Universität zu Berlin for the loan of certain type specimens upon which Friese (1903, 1911) based the descriptions of *Xylocopa eburnea* and *X. tegulata*. Dr. M. A. Lieftinck, Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands, kindly helped make this loan possible. Our thanks are also due Dr. Belindo A. Torres, Facultad de Ciencias Naturales y Museo de La Plata, Argentina, for his most helpful assistance during our study of the carpenter bee specimens in his care, and to Dr. Frederico Lane, Departamento de Zoologia da Secretaria da Agricultura, São Paulo, Brasil, for generously facilitating our examination of the type of *X. bambusae* Schrottky (1902). Other assistance made available to us is acknowledged elsewhere in this study.

Celeste Green, Senior Scientific Illustrator, Department of Entomology and Parasitology, University of California. Berkeley, prepared the accompanying illustrations.

Xylocopa ciliata Burmeister
(Figs. 1-3)

Xylocopa ciliata Burmeister, 1876, Stettiner Ent. Zeitg., 37:158-159 (male, "In der Banda Oriental bei Buenos Aires und Paraná häufig"); Taschenberg, 1879, Zeitschr. f. d. Gesammt. Naturwiss., Berlin, 52: 582-583 (male, female, ". . . aus der Banda Oriental, Lagoa Santa"); Holmberg, 1884, Actas Acad. Cienc. Cordoba, 5(2):135 (Argentina: Tandil, Buenos Aires; Curá-malal); Dalla Torre, 1896, Cat. Hymen., 10:208; Kriechbaumer, 1900, Berliner Ent. Zeitschr., 45:107 (Uruguay); Schrottky, 1902, Rev. Mus. Paulista, 5:459, 462, 470 (male, female, Argentina: Buenos Aires. Brazil: Paraná; Lagoa Santa, Minas Gerais); Schrottky, 1903, An. Soc. Cient. Argentina, 55:181 (Argentina: Buenos Aires. Brazil: Paraná. Uruguay); Friese, 1903, Zeitschr. f. Hymen. u. Dipt., 3:203; Schrottky, 1908, Zeitschr. Wiss. Insektenbiol., 4:76 (Paraguay: Posados); Strand, 1910, Zool. Jahrb. Abt. Syst., 29:458,503,504 (male, female, Paraguay: Asunción. Uruguay); Strand, 1912, Zool. Jahrb. Abt. Syst., 33:266 (male, female,

Paraguay: Asunción); Schrottky, 1913, An. Soc. Cient. Argentina, 75:253 (Argentina: Buenos Aires. Paraguay. Brazil); Brèthes, 1916, Physis, 2:408, 410-411, 420, 421 (male, female, Argentina: Buenos Aires; Misiones); Bertoni, 1918, An. Cient. Paraguayos, ser. 2, num. 3:219, 220 (Argentina: Santa Fe. Paraguay: "de Asunción y otros puntos de la región con campos, pero que faltan en Pto. Bertoni"; Cockerell, 1919, Proc. U.S. Natl. Mus., 55:168 (female, Argentina: Carcaraña); Malyshev, 1931, Zeitschr. Morphol. Ökol. Tiere (A)23(3-4):794; Moure, 1943, Arquivos Mus. Paranaense, 3:168;Moure, 1948, Rev. Ent., Rio de Janeiro, 19:335.

Xylocopa cavicornis Pérez, 1901, Act. Soc. Linn. Bordeaux, 56:70-71 (female, "Uruguay"); Maidl, 1912, Ann. K. K. Naturhist. Hofmus. Wien, 26:311, 316 (female, Argentina: Buenos Aires); Schrottky, 1913, An. Soc. Cient. Argentina, 75:252 (Uruguay).

Xylocopa artifex, Ducke, 1910, Deutsche Ent. Zeitschr., p. 364 (male, female), *nec* Smith, 1874:289, misidentification.

Xylocopa carbonaria, Enderlein, 1913, Arkiv. Naturgesch., (A)79:165, *nec* Smith, 1854:358, misidentification.

Brèthes (1916:410) and Moure (1948:335) have previously declared that *X. cavicornis* Pérez is a synonym of *X. ciliata* Burmeister. This synonymy was confirmed by Moure in 1958 while studying the type specimens of bees contained in the collections of the Muséum National d'Histoire Naturelle, Paris. Subsequently the homotype specimen (female) established by Moure was compared and found to be in structural agreement with the female specimen of a nest-associated pair of this species. The male of this nest-associated pair was then compared by us with the male type of *X. ciliata* Burmeister on deposit in the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires. Clearly *X. cavicornis* Pérez is a synonym of the earlier described *X. ciliata* Burmeister.

Following these studies we discovered a number of nests in the environs of Curitiba and Ponta Grossa, Paraná, Brazil, which contained the sexes of *X. ciliata.* These nests had been or were in the process of being constructed in the hollow, internodally partitioned dead flower stalks of *Eryngium* (Umbelliferae). Since Holmberg (1884:135), Schrottky (1908:76), and Strand (1912:266) have likewise recorded this species nesting in the dead floral stalks of *Eryngium,* and since no other nesting substrate has been demonstrated, not even in our field investigations, it may be that this species is restricted in its choice of nesting sites to this and possibly other plants of similar growth form. At least in the State of Paraná in Brazil, the genus *Eryngium* is a plant of the grasslands, open fields, and pasturelands. This may explain the distribution and ecological restriction of *X. ciliata* which we, like Bertoni (1918:220) in Paraguay, have observed is limited to these areas. Neither we nor Bertoni observed the species in such ecological situations as those afforded by forests, wooded canyons, or the like. As a consequence of the extensive winter burning of the fields and pasturelands in Paraná, an inestimable number of nests containing hibernating bees are destroyed each year. Thus local populations sometimes completely disappear, as was observed in one area near Ponta Grossa, Paraná, but are

doubtless re-established when *Eryngium* floral stalks again become available.

Our studies of museum material reveal that *X. ciliata* is distributed from the Province of Buenos Aires, Argentina, northward through Uruguay into the State of Paraná in Brazil and at least into the eastern grasslands of Paraguay (Asunción, Posados, etc.). We have seen one male specimen labelled from Bolivia without further particulars.

Although some structural characteristics suggest an affinity with certain species of the subgenus *Schönherria, X. ciliata* occupies an isolated position among the New World *Xylocopa.* The genitalia of the male (figs. 1-3) bears little similarity to those of the subgenus *Schönherria.* The gonocoxites are apically undivided, distinctly shaped, and unlike any known New World *Xylocopa.* The entirely punctate tegulae of the male is likewise a unique feature among the American *Xylocopa.* The female possesses a transverse, somewhat tuberculiform, frontal carina. In this respect it is reminiscent of the female of *X. hirsutissima* Maidl, a member of the subgenus *Neoxylocopa.* However, in that subgenus, among several other fundamental characteristics, the apical margin of the first metasomal sternum is entire in the female while it is deeply and angularly notched medially in the female of *X. ciliata.*

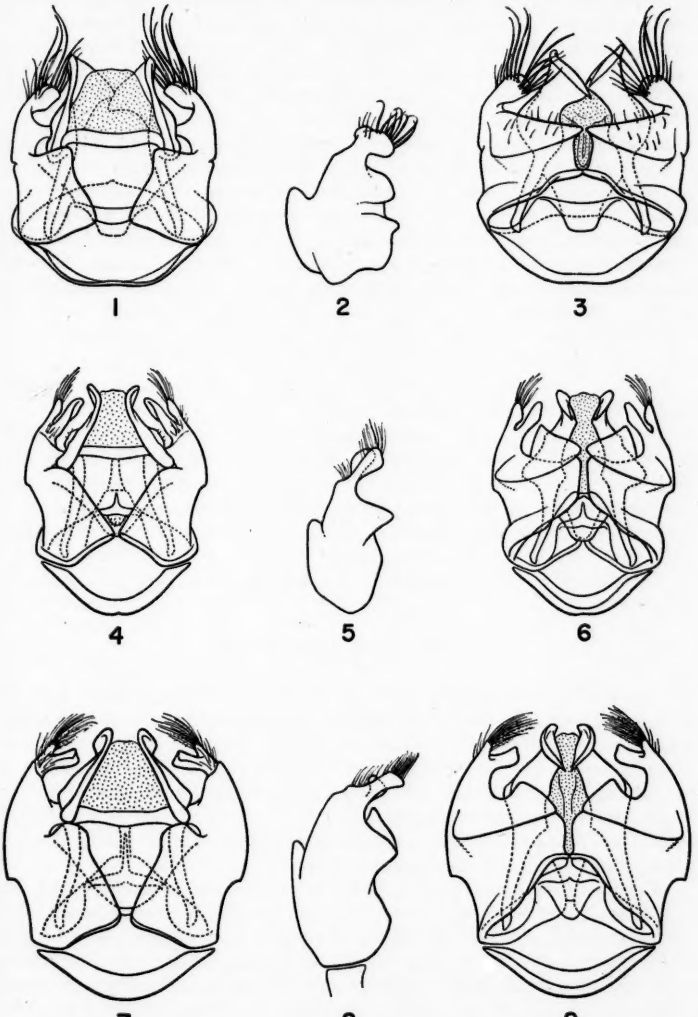
Xylocopa fenestrata (Fabricius)

Apis fenestrata Fabricius, Ent. Syst. Suppl., p. 273 (male, "Habitat in India orientali").

Xylocopa fenestrata, Fabricius, 1804, Syst. Piez., p. 339; *teste* Maa, 1938, Rec. Indian Mus., Calcutta, 40:285-288, and Maa, 1954, Vidensk. Meddel. Dansk Naturhist. For. København, 116:221-222 for synonymical bibliographies.

Xylocopa serripes Burmeister, 1876, Stettiner Ent. Zeitg., 37:156-157 [male, female, Brazil: "bei Rio de Janeiro (Laranjeiras, im Garten meines Freundes Lallemant fing. . .")] Dalla Torre, 1896, Cat. Hymen., 10:218; Schrottky, 1902, Rev. Mus. Paulista, 5:458,462,469 (male, female); Brèthes, 1916, Physis, 2:407; Maa, 1940, Notes d'Ent. Chinoise, Shanghai, 7:131; Hurd, 1958, Ann. Ent. Soc. Amer., 51:368. New synonymy.

Xylocopa serripes Burmeister (1876:155-156) was described from two specimens, a male and female, which had been found in a garden in the Laranjeiras district of Rio de Janeiro, Brazil. Since no subsequent specimens were collected, and since the structural features outlined by Burmeister are unlike any New World member of the genus *Xylocopa,* it was suggested by Moure (Hurd, 1958:368) that these specimens might have had an adventive origin. This view was strengthened during the seasons of 1957-1959 when an intensive *Xylocopa* collecting program by Dr. Carlos Alberto Campos Seabra of Rio de Janeiro and his collectors failed to confirm the presence of *X. serripes.* It was, therefore, not surprising that our examination of the Burmeister type specimens revealed that *X. serripes* is the very well known *X.* (*Ctenoxylocopa*) *fenestrata* (Fabricius) of tropical Asia. Maa (1954:221-222) states that it is a common and widely distributed species of lowland India and Ceylon and that he has also seen



Genitalia of *Xylocopa ciliata* (figs. 1-3), *X. bambusae* (figs. 4-6), and *X. viridigastra* (figs. 7-9). Left to right, dorsal view, lateral view, and ventral view. Drawings prepared by Celeste Green, Senior Scientific Illustrator, University of California, Berkeley.

specimens from Burma, Nepal, Baluchistan, Kashmir and Iran. Maa (1938: 288) previously had noted that the species had been also recorded from "Mesopotamia, Mauritius, Madagascar, the Andamans, Celebes (?), and French Indo-China (?)." If the specimens were correctly identified by the earlier authors, it is possible that some of these specimens were collected as adventives.

Although the holotype male of *X. serripes* lacks the two metasomal segments including the gentitalia, there is no doubt that it is a synonym of *X. fenestrata*. The posterior metatarsi are normal. The postero-lateral lobes of the pronotum are markedly prolonged posteriorly so as to extend well on to the mesepisterna with their posterior margins nearly attaining the vertical portion of the scrobal suture. The allotype female likewise agrees with the female of *X. fenestrata* particularly in the structure of the basitibial plates and in the arrangement of the pygidial plate.

Xylocopa nigrocincta var. *jujuyensis* Brèthes

Xylocopa nigrocincta var. *jujuyensis* Brèthes, 1916, Physis, 2:410,420 (female, Argentina: ". . . est de Jujuy").

The lectoholotype, a female labelled "Jujuy: Travi" and without further particulars, does not differ significantly in structure from females of *X. nigrocincta* Smith, Unlike *X. nigrocincta* Smith, the metasomal terga are without reddish integumental bands. The metasoma is also somewhat more punctate, especially on the second metasomal tergum. The wings are darker and effulgently blue-green.

The discovery of the male will doubtless prove a more precise indication of its status.

Xylocopa bambusae Schrottky
(Figs. 4-6)

Xylocopa bambusae Schrottky, 1902, Rev. Mus. Paulista, 5:462, 475-476 (male, "Rio Grande do Sul"); Ihering, 1904, Rev. Mus. Paulista, 6:473 (male, Brazil); Brèthes, 1916 Physis, 2:420; Bertoni, 1918, An. Cient. Paraguayos, ser. 2, núm. 3:219.

Xylocopa eburnea Friese, 1903, Zeitschr. f. Hymen. und Dipt., 3d year, no. 1:202-203 (male, female, Brazil: ". . . von Rio Grande do Sul"); Maidl, 1912, Ann. K. K. Naturhist. Hofmus. Wien, 26:316 (male, female, Brazil: Rio Grande). New synonymy.

Xylocopa bambusae Schrottky (1902:475-476) was described on the basis of a single male from Rio Grande do Sul, Brazil. In September of 1959 while studying the bee specimens contained in the collections of the Departamento de Zoologia da Secretaria da Agricultura in São Paulo, Brazil, it was immediately apparent that this specimen agreed in every detail with a cotype male of *X. eburnea* Friese (1903:202-203) on loan from Dr. G. Steinbach. This latter species was founded upon "2 ♀ und 2 ♂ von Rio Grande do Sul; 1 ♂ im Mus. Berlin. (S.-Brazil)." Since the cotype male of *X. eburnea* agrees with the original description and bears a printed label "TYPE," it is selected herewith to serve as the lectoholotype of *X. eburnea* Friese. The specimen bears, in addition to our

lectoholotype designation, three labels, the uppermost of which reads, "Rio Grande Brazil," the next label in Friese's handwriting reads, "Xylocopa eburnea Fr. ♂" with a press printed inscription "1900 Friese det.," and a lower red label with a machine printed inscription "TYPE." Consequently, *X. eburnea* Friese is declared a synonym of the earlier described *X. bambusae* Schrottky. The female specimens assigned by Friese to *X. eburnea* are correctly associated. One female bearing the same data as the lectoholotype is designated to serve as the lectoallotype.

Brèthes (1916:413-414) described a new species, *Xylocopa bellula,* from, ". . . une série d'exemplaires [females] de cette espèce qui proviennent tous de Misiones [Argentina]." A study of these specimens in October of 1959 revealed that they are females of *X. bambusae* and accordingly *X. bellula* is synonymized with that species. Since no holotype was designated by Brèthes, we have selected a female specimen from the original series, labelled as lectoholotype by Moure and Michener in April of 1956, to serve that purpose. The locality label reads: Misiones, XII-1911, Abel Muniez.

The male of this curious species is readily recognized by the large eburneous maculations on the metasomal terga. The female, in addition to possessing very short and ovate parapsidal lines, exhibits a rather conspicuous pruinosity on the head and on the sparsely punctate dorsum of the thorax. The frontal carina of the female is short, carinotuberculiform, and quite strongly elevated at the apex. In profile it is very nearly triangular in outline. The punctation of the mesoscutum does not extend mesad of the parapsidal lines. The punctures between the tegulae and the parapsidal lines are very sparse, being separated by approximately four diameters from one another. The basitibial plate of the female is broad, especially near the asymmetrically bifid distal apex. The distal apex of the basitibial plate is situated much beyond the middle of tibia (80:27). Metasomal terga III-V of the male each possess a complete, but laterally abbreviated gradulus, while the metasomal terga of the female are without graduli. Both sexes exhibit graduli on the metasomal sterna, but those of the female are expressed only on the three anterior sterna.

The structure of the male genitalia (figs. 4-6) suggests an affinity with the subgenus *Schönherria.* Even so, it is noteworthy that none of the known species of that subgenus possess similarly maculated metasomal terga, tegulae with pubescent posterolateral margins, or similarly constituted basitibial plates.

Including the type specimens discussed above, we have examined only nine males and 22 females from three localities. Most of these specimens were collected in Misiones, Argentina (February 2-August 22), two are from Rio Grande do Sul, Brazil, and five females are labelled from Nova Teutonia, Santa Catarina, Brazil (April, October, and December).

One male in the collection of the Facultad de Ciencias Naturales y Museo de La Plata, Argentina, taken by P. Jörgensen in the province of Misiones, Argentina, on August 21, 1909, has almost black-brown pubescence on the head, thorax, and abdomen, strikingly darker than that of the other males available for study. Moreover, the integumental mac-

ulations on the metasomal terga appear as though they were altered in coloration by overexposure to cyanide gas.

Schrottky (1902-476) remarked that according to the observations of Dr. R. von Ihering, this species constructs its nests in taquara and bamboo.

Xylocopa tegulata Friese

Xylocopa tegulata Friese, 1911, Deutsche Ent. Zeitschr., p. 686 [female, "... von Tarata (Bolivien)"].

Xylocopa boliviana Brèthes, 1916, Physis, 2:408,409,420 [female, "Santa Cruz (Bolivia)"]. New synonymy.

This species, known only from the female, is a member of the subgenus *Neoxylocopa*. It was first described by Friese (1911:686) on the basis of a number of specimens from Tarata, Bolivia, as *X. tegulata*. One of the *X. tegulata* cotypes, labelled as "TYPE" and herewith so designated, on loan from Dr. G. Steinbach was compared during our stay in Buenos Aires with the unique female type of *X. boliviana* Brèthes (1916:409). This specimen, which had been collected in Santa Cruz, Bolivia, is in structural agreement with the lectoholotype of *X. tegulata* Friese and consequently *X. boliviana* Brèthes is declared a synonym. The type specimen of *X. boliviana* is without antennal segments beyond the scape. The reddening of certain areas of the integument (base of scutellum, much of the propodeum, bases of metasomal terga I-IV, basal sides of metasomal tergum V, large spots on disc of metasomal tergum VI, metasomal sterna, and large areas on legs) is very likely due to the advanced age of the specimen at the time of its collection or to a temporary submersion in a liquid preservative. This change in coloration is occasionally observed among the females of the subgenus *Neoxylocopa*.

The female of *Xylocopa tegulata* Friese is an ordinary appearing *Neoxylocopa* which is readily recognized by the ferruginous tegulae coupled with the absence of reddish pubescence on the dorsum of the thorax. Structurally it is closely related to *X. tacanensis* Moure and *X. rufidorsum* Enderlein.

Xylocopa augusti Lepeletier
(Figs. 10-12)

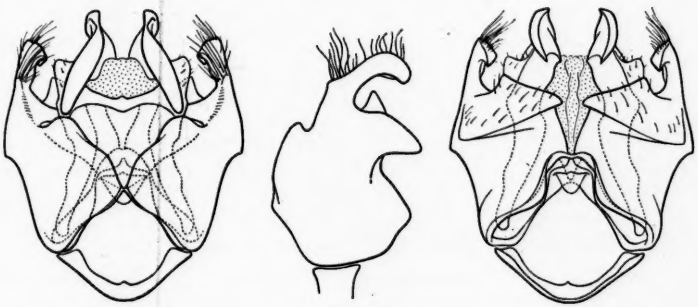
Xylocopa augusti Lepeletier, 1841, Histoire naturelle des insectes, hyménoptères, 2:187 (female, "Du Brésil"); Smith, 1854, Catalogue of hymenopterous insects in the. . .British Museum, 2:360 (female, Brazil); Smith, 1874, Trans. Ent. Soc. London, p. 286 (female, Brazil; South America (Rio Grande [do Sul]); Burmeister, 1876, Stettiner Ent. Zeitg., 37:153-154 (male, female, Argentina: Buenos Aires. Brazil: Paraná); Taschenberg, 1879, Zeitschr. f. d. Gesammt. Naturwiss., Berlin, 52:571-572 (male, female, Argentina: Banda Oriental. Brazil: Paraná; Rozario); Dalla Torre, 1896, Cat. Hymen., 10:205; Pérez, 1901, Act. Soc. Linn. Bordeaux, 56: 83-84 (female), p. 101 (male); Schrottky, 1902, Rev. Mus. Paulista, 5:460, 462, 466-467 (male, female, Argentina: La Plata. Brazil: Porto Alegre, Rio Grande do Sul); Schrottky, 1903, An. Soc. Cient. Argentina, 55:181 (Argentina: Buenos Aires. Brazil: Paraná);

Schrottky, 1904, Allgemeine Zeitschr. f. Ent., 9:346-347 (Paraguay); Schrottky, 1908, Zeitschr. Wiss. Insektenbiol., 4:23, 24, 25, 26, 47, 48, 50, 76 (female, Paraguay); Maidl, 1912, Ann K. K. Naturhist. Hofmus. Wien, 26:317 (female, Argentina: Buenos Aires. Brazil: Rio Grande [do Sul], Rio Grande do Sul. Uruguay: Montevideo); Enderlein, 1913, Arch. Naturgesch., (A)79(2):158 (female, Brazil); Schrottky, 1913, An. Soc. Cient. Argentina, 75:252 (Argentina: Provinces of Buenos Aires, Entre Ríos, Misiones. Uruguay. Paraguay.); Brèthes, 1916, Physis, 2:408, 414-415, 420, 421 (male, female, Argentina: Misiones); Bertoni, 1918, An. Cient. Paraguayos, ser. 2, núm. 3:220 (Paraguay: "de Asunción y otros puntos de la región con campos, pero que faltan en Pto. Bertoni."); Dusmet y Alonso, 1924, Trabajos del Museo Nac. cienc. Nat., ser. Zool. Núm., 49:45 (male, female, Paraguay: Villa Encarnación); Friese, 1923, Die europäischen Bienen, p. 419; Cockerell, 1926, Ann. Mag. Nat. Hist., (9) 17:660; Malyshev, 1931, Zeitschr. Morphol. Ökol. Tiere (A)23(3-4): 792-793; Linsley, 1944, Bull. Brooklyn Ent. Soc. 39(2):54; Pate, 1947, Acta Zool. Lilloana, Tucumán, 4:409, 420; Hurd, 1958, Ann. Ent. Soc. Amer., 51:369 (Brazil: Araucaria, Paraná); Hurd, 1959, Jour. Kansas Ent. Soc., 32(2):58 (Brazil: Araucaria, Paraná).

Xylocopa ferruginea Lepeletier, 1841, Histoire naturelle des insectes hyménoptères, 2:187 (female, "Bengale"); Smith, 1854, Catalogue of hymenopterous insects in the . . . British Museum, 2:353; Smith, 1873, Jour. Proc. Linn. Soc. London, Zool., 11:393; Ritsema, 1876, Tijdschr. Ent., 19:63; Dalla Torre, 1896, Cat. Hymen., 10:212; Bingham, 1897, Fauna British India, Hymen., 1:543; Maa, 1938, Rec. Indian Mus., Calcutta, 40:328. *nec ferruginea* (De Geer, 1773:575). New synonymy.

Xylocopa augusti var. *pterochloris* Brèthes, 1916, Physis, 2:414, 420 (female, Argentina: ". . . de Misiones"). New synonymy.

Xylocopa guaranitica Brèthes, 1916, Physis, 2:415-416, 420 (female, Argentina: "Misiones"). New synonymy.



Genitalia of *Xylocopa augusti*, fig. 10, dorsal view, fig. 11, lateral view, and fig. 12, ventral view. Drawings prepared by Celeste Green, Senior Scientific Illustrator, University of California, Berkeley.

This species, a member of the subgenus *Neoxylocopa,* is easily known in the female by the conspicuous ferruginous colored hairs situated along the sides and apex of the metasoma. This characteristic is not shared by other species of this subgenus. There is much nonsegregable variation in the extent of this colored fringe, and in only one specimen studied thus far is it nearly absent. It sometimes is very broad with the ferruginous hairs extending nearly to the dorsal mid-line of the metasoma. The male of *X. augusti* possesses two well separated tufts of hairs on the ventral surface of the hind tibia. The latter, though globularly swollen at its inner distal apex, is without cariniform tubercles or dentiform processes. The genitalia are as illustrated (figs. 10-12). *X. augusti* ranges from the Province of Buenos Aires in Argentina northward through Uruguay into southern Brazil (State of Paraná) and westward into Paraguay. In Paraná, Brazil, we found its nests most frequently in structural timbers, especially in fence posts and buildings of various types. In one instance, a nest of this species was located in the same fence post containing active nests of two other species, *X. frontalis* (Olivier) and *X. hirsutissima* Maidl.

An examination of the type series of *X. ferruginea* Lepeletier by one of us (Moure) reveals that there are two females from the Serville collection labelled "Bengale" and "Senegal" respectively. Since Lepeletier (1841:187) cites the "Bengale" specimen it is to be considered the holotype. Both of these specimens are in complete agreement structurally with the South American *X. augusti* and consequently *X. ferruginea* Lepeletier is declared a synonym. It should be noted that in any event *X. ferruginea* Lepeletier is in homonymic conflict with the earlier described *X. ferruginea* (De Geer, 1773:575). The latter, based upon the male, is a member of the subgenus *Neoxylocopa* and very likely is the male of *X. aeneipennis* (De Geer).

The holotype female of *X. augusti* var. *pterochloris* Brèthes is labelled "4789" [= Misiones, IX-10-93] and agrees in structural details with *X. augusti.* The wings are somewhat darker and exhibit greenish-blue reflections. The lateral ferruginous colored hair fringes of the metasoma are very broad. Since these differences are manifest in other specimens of *X. augusti,* and since these variations are nonsegrable ecologically or geographically, no taxonomic significance is attached.

Another color variant of similar status is represented by a female specimen described from Misiones, Argentina, as *X. guaranitica* Brèthes. The dorsal thoracic vestiture of this specimen apparently was ferruginous, at least peripherally; but since most of the central hairs are missing on the holotype, it is also possible that the specimen was aged or otherwise altered at the time of collection. Accordingly this variation may not be indicative of the original coloration of the vestiture.

Xylocopa simillima Smith

Xylocopa simillima Smith, 1854, Catalogue of hymenopterous insects in the . . . British Museum, pt. 2, pp. 357-358 (female, "Hab. Australia"): Smith, 1874, Trans. Ent. Soc. London, p. 281 (female, "Hab. Australia"): Dalla Torre, 1896, Cat. Hymen., 10:218.

Xylocopa mendax Maidl, 1912, Ann. K. K. Naturhist. Hofmus, Wien, 26:319-320, pl. 4, fig. 18 (female, "1 ♀ aus Brasilien (Rio Grande [do Sul] und 1 ♀ ohne Fundortsangabe"). New synonymy.

Xylocopa rotundiscuta Brèthes, 1916, Physis, 2:418-420, 421 (female, Argentina: "de Misiones"). New synonymy.

During a type study of the American *Xylocopa* contained in the collection of the British Museum (Natural History) by one of us (Moure) in 1957, it was recognized that *Xylocopa simillima* Smith (1854:357-358) was not an Australian species as Smith had recorded, but rather a South American *Xylocopa* which subsequently had been described on the basis of additional females first as *X. mendax* Maidl (1912:319-320) and later as *X. rotundiscuta* Brèthes (1916:418-420). A homotype female was established by Moure during the examination of *X. simillima* Smith; and this specimen was later compared by him with the type females of *X. mendax* Maidl, "1 ♀ aus Brasilien (Rio Grande [do Sul] ges. v. Ihering) und 1 ♀ ohne Fundortsangabe (Coll. Winthem)," in the collections of the Naturhistorisches Museum, Vienna, Austria. As a consequence of that investigation, *X. mendax* Maidl is to be regarded as a synonym of the earlier described *X. simillima* Smith. When this same homotype was compared by us with the ". . . trois exemplaires de cette espèce [*X. rotundiscuta* Brèthes] que proviennent de Misiones, [Argentina]," in the collections of the Museo Argentino de Ciencias Naturales "Bernardino Rivadavia," Buenos Aires, the suspected synonymy with both *X. mendax* Maidl and *X. simillima* Smith was confirmed. One of the three females of *X. rotundiscuta* Brèthes already labelled as lectoholotype by Moure and Michener in April of 1956 is now designated to serve this purpose. It is labelled "Misiones, 2597." The other two female specimens of the original type series bear only the cryptic "753" Brèthes locality label in addition to the lectoparatypic designations. One other female associated with these specimens is from Puerto Bertoni, Paraguay, November 19, 1909. It is clear from the type locality statement provided by Brèthes (1916:420) that this specimen was not part of the original type series.

The surprisingly similar appearance of *X. simillima* Smith (female), a member of the subgenus *Schönherria,* with that of *X. nigrocincta* Smith (female), an unrelated South American species belonging to the subgenus *Neoxylocopa,* caused Strand (1909:230) to record the latter from San Bernardino, Paraguay, as *X. simillima* Smith. Subsequently, Strand (1910:501-502) reidentified his Paraguayan specimens as *X. nigrocincta* on the difference in the number of labral tubercles provided by Smith (1854:354, 357). The strikingly strong resemblances between the females of these species is especially interesting since they occur together throughout much of their respective geographic ranges. The male of *X. simillima* is unknown.

Xylocopa viridigastra Lepeletier
(Figs. 7-9)

Xylocopa viridigastra Lepeletier, 1841, Histoire naturelle des insectes, hyménoptères, 2:186 (female, "Du Pérou"); Smith, 1854, Catalogue of the

hymenopterous insects in the . . . British Museum, pt. 2, p. 362 (Cayenne [*sic!*]); Smith, 1874, Trans. Ent. Soc. London, p. 294 (male, female, Perú); Dalla Torre, 1896, Cat. Hymen., 10:222; Cameron, 1903, Trans. Amer. Ent. Soc., 29:237 (Ecuador: Chillo, 9,000 ft.; Nanegal, 3-4,000 ft.; Quito, 9,000 ft.); Ducke, 1910, Deutsche Ent. Zeitschr., p. 364; Enderlein, 1913, Arch. Naturgesch., (A)79(2):165 (male, female, Ecuador: Loja; Quito. Perú: Dept. Cuzco, 3,000-4,000 meters; Dept. Urubamba, 2,800 meters; Prov. Chanchamayo; Callaga); Brèthes, 1920, An. Soc. Cient. Argentina, 89:52 (Perú: Arequipa); Moure, 1944, Bol. Mus. Hist. Nat., Lima, 8:67 (Perú).

Xylocopa martinezi Brèthes, 1924, Nunquam Otiosus, Buenos Aires, 2:16 (male, Perú: ". . . de Lima. . ."). New synonymy.

Xylocopa alfkeni Dusmet y Alonso, 1924, Trabajos del Museo Nac. Cienc. Nat., ser. Zool. Núm. 49:44 (male, "Ecuador"). New synonymy.

The unique type of *Xylocopa martinezi* Brèthes (1924:16), a male, was sent to Brèthes by Dr. Esequiel Martínez from Lima, Perú. A comparison of this specimen with a male of *X. viridigastra* Lepeletier (1841:186), whose nest-associated female had been compared with the Lepeletier type series by one of us (Moure), revealed that *X. martinezi* Brèthes is a synonym of *X. viridigastra* Lepeletier. Similarly, a comparison by Moure of the aforementioned male of *X. viridigastra* Lepeletier with the holotype male of *X. alfkeni* Dusmet y Alonso (1924:44) from "Ecuador" contained in the Instituto Español de Entomologia, Museo de Ciencias Naturales, Madrid, reveals that it likewise is a synonym of *X. viridigastra* Lepeletier.

Xylocopa viridigastra Lepeletier is a medium-sized member of the subgenus *Schönherria.* The posterior margin of the seventh metasomal tergum of the male is produced into a well-separated pair of long, acute teeth. This prominent characteristic is not shared with other species of the subgenus *Schönherria,* but curiously the males of the Old World subgenera *Copoxyla, Ctenoxylocopa,* and *Hoplitocopa* as well as those of the American subgenus *Notoxylocopa* possess a similarly modified metasoma. The structure of the male genitalia (figs. 7-9) shares the same fundamental features with those of other males in the subgenus *Schönherria.* The female of *X. viridigastra* is readily distinguished from the females of other species in the same subgenus by the number and disposition of the labral tubercles. The labrum is essentially trituberculate with the lateral tubercles directed obliquely toward the longitudinal median tubercle.

The majority of the specimens that we have studied were collected in Perú at various localities on both the eastern and western flanks of the Andes. Most of these specimens are labelled from localities in the 2,000 to 3,000 meter level, but we have studied some labelled from the near sea level city of Lima and others from the 4,000 meter level near Cuzco. A few specimens have been seen from Ecuador (Cuenca, 2,650 meters; Guayaquil, 5 meters; La Asunción, 2,600 meters; and Chin Chan Pass, 1,200 meters) and Chile (Arica, Azapa, Camarones, and Mocha in Tarapacá Province). The earliest collected specimen of this species that we

have studied from Chile is contained in the collection of the Museo Nacional de Historia Natural Santiago de Chile. It is a male labelled: Sibaya, 2,680 meters, 19°48′S, 69°11′W, March, 1885, F. Philippi and was kindly located during our visit there by Padre Guillermo Kuschel of the Universidad de Chile.

Ruiz (1929:300; 1940a:25; 1940b:291) in his observations on the occurrence of the genus *Xylocopa* in Chile concluded that only two species, *X. splendidula* Lepeletier and *X. brasilianorum* (Linnaeus), reached the northern frontier of that country. It seems likely that *X. brasilianorum sensu* Ruiz may be the same species as *X. tricuspidifera* Kriechbaumer (a *Neoxylocopa sensu* Moure), recorded from Arica, Chile, by Moure (1949:458; 1951:320). However, Schulz (1904:262) has stated that the metasoma of *X. tricuspidifera* possesses a metallic coloration (". . . dunkelgrün gefärbt . . . und jedes Segment vor der Mitte eine ponceaufarbene Querbinde trägt.") and is, therefore, not to be associated with those species of *Xylocopa* which are properly assigned to the subgenus *Neoxylocopa.* In view of the metallic coloration and the "tricuspidate" labrum it is possible that *X. tricuspidifera* is a *Schönherria.* If so, it is probably a synonym of *X. viridigastra.* A study of the Kriechbaumer (1900:106) type material of *X. tricuspidifera* from "Arequipa (Südperu)" is essential to determine its status.

With the kind help of Padre Inocencio Beltrán Beltrán, Colegio San Pedro Nolasco, Santiago de Chile, we were able to locate in the Ruiz collection, housed in that institution, a female specimen of *X. (Schönherria) splendidula* Lepeletier labelled from "Valle de Azapa coll. Dr. Porter." This is the only specimen of that species we have seen from a locality west of the Andean cordillera. It is to be noted, however, that Maidl (1912:319) also records "1 ♀ aus Chile." The specimen of *X. splendidula* in the Ruiz collection is doubtless the specimen recorded by Ruiz (1940a:25). The geographic range of *X. splendidula* as determined from the literature includes Argentina, Bolivia, Brazil, Chile, México, Nicaragua, Panamá, Paraguay, Perú, and Uruguay. With the exception of the aforementioned specimen from Chile, we have seen material of this species only from Argentina, Bolivia, Brazil, Paraguay, and Uruguay. We have, nonetheless, studied some of the Central American specimens previously attributed to this species and find them to be incorrectly identified.

Cockerell (1912:492) described a subspecies (females only), *X. splendidula charapensis,* from the Rio Charape, 5,000 ft., Perú; but that form, even if validly associated with *X. splendidula,* is readily distinguishable by the brilliant orange-ferruginous pubescence on the outer surfaces of the hind basitarsi.

On the basis of present knowledge, the *Xylocopa* fauna of Chile consists of three species (two species of the subgenus *Schönherria: X. viridigastra* and *X. splendidula;* and one species of the subgenus *Neoxylocopa* currently considered to be *X. tricuspidifera*) all from the northern coastal province of Tarapacá. Since all of the several thousand specimens of *X. splendidula* that we have studied, except those reported by Maidl (1912: 319) and Ruiz (1940a:25) and discussed above, originate from localities

east of the Andean crest, further collecting of *Xylocopa* in Tarapacá Province, Chile, would seem desirable so as to confirm the presence of this species on the Pacific Coast side of the South American Andes.

Although Smith (1854:362) listed *X. viridigastra* from *"Hab.* Cayenne," it is likely that this was an error of transcription since in his subsequent monograph of the genus (1874:294) he records the species from Perú only. We have not seen specimens of this species more northeasterly than Ecuador.

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EFFECT OF DOCKAGE ON THE EFFICIENCY OF 80:20 (CARBON TETRACHLORIDE:CARBON DISULFIDE BY VOLUME)[1] AS A FUMIGANT FOR ADULT RICE WEEVIL, *SITOPHILUS SASAKII (TAK.) IN WHEAT*[2]

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Dockage in grain may be defined as foreign material that is removed by appropriate sieves or cleaning devices and undeveloped, shriveled and small pieces of grain removed with foreign material but which cannot be recovered by proper rescreening or recleaning (U.S.D.A. 1957). Weed seeds, sand, cinders, ashes, stones, leaves, stems, cobs, insect fragments, rodent excreta, broken kernels, shriveled kernels, dust and chaff are some dockage materials often found in grain. Dockage generally increases total surface area per given volume resulting in a grain mass with greater sorptive capacity. An increase in sorptive capacity causes a greater loss in fumigant gas from interkernel air spaces so that dosage for satisfactory insect control must be increased when fumigating grain containing dockage.

Walkden *et al.* (1951) found the efficiency of 75:25 (ethylene dichloride:carbon tetrachloride by volume) reduced in controlling stored grain

[1] Fumigant prepared and supplied by the Diamond Alkali Company.

[2] Contribution No. 778, Department of Entomology, Kansas Agricultural Experiment Station, Manhattan. Supported in part by research grant E-1942 from the National Institutes of Health, Allergy and Infectious Diseases, U.S. Public Health Service. Investigations conducted under the direction of D. A. Wilbur, Professor of Entomology, Kansas State University.

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insects in wheat containing 3 per cent or more dockage. Dockage in new Hard Red Winter wheat generally does not exceed 1 per cent; however, the percentage of broken kernels and grain dust increases when wheat is periodically removed from storage for transporting, drying, aerating, etc. As wheat is returned to storage, light dockage settles around the outside of the grain mass and heavier dockage near the center causing channeling of fumigating gases. Dockage may reach 10 per cent in various areas, especially if infested with insects.

This 1959 study was to test the efficiency of 80:20 (CCl_4:CS_2 by volume) as a fumigant against adult rice weevil, *Sitophilus sasakii* (Tak.), (Floyd and Vincent, 1960) in wheat containing various percentages of dockage.

MATERIALS AND METHODS

No. 1, Hard Red Winter wheat was cleaned to reduce dockage to less than 1 per cent, and tempered with distilled water to approximately 12 per cent moisture in 55-gallon barrels. Each barrel of wheat was rotated 30 minutes on each of 5 consecutive days before desired moisture equilibrium was obtained: 12±0.2 per cent.

Twenty-five pounds of ground wheat were sifted through a No. 0.064 x ⅜ metal sieve and a No. 20 wire screen to separate broken wheat kernels and whole wheat meal. Both type dockages were tempered to 12±0.2 per cent moisture and then added to tempered wheat to give 2000 gram samples containing 0, 1, 2, 4, 6, 8, 10 and 12 per cent dockage by weight. Wheat samples were placed in separate 1-gallon fumatoria which were narrow-mouthed glass jars fitted with self-sealing Mason lids. Dockage and wheat were mixed in fumatoria by handshaking 50 times followed by 15 minutes rotation on a mechanical tumbler.

Weevils were reared at 80±2° F. and 70±5 per cent relative humidity in 1-quart Mason jars containing Hard Red Winter wheat. Cultures were changed every 3 days to provide weevils 14±1.5 days old.

Two cylindrical insect cages (2 ½ inches long by ½ inch diameter made of 60-mesh brass screen) containing 50 adult weevils each were placed in the center of wheat samples within each 1-gallon fumatorium. Fumatoria were then stored 24 hours at 80±2° F. At termination of storage, 145 microliters of 80:20 (CCl_4:CS_2 by volume) were introduced into each fumatorium, using a micro syringe as described by Pedersen (1959). The fumigant was directed onto a 9-cm. filter paper suspended on a L-shaped steel wire soldered to the inner surface of the lid. Following 24-hour exposure at 80±2° F., weevils were removed and mortality observed. Dead and live weevils were held in small plastic boxes containing wheat until 10- and 20-day mortality counts were completed. Weevils were considered alive if they moved. Mortalities reported were those observed 10 days following termination of exposure. All tests were replicated three times.

RESULTS AND DISCUSSION

The average mortality of weevils fumigated in wheat mixed with broken wheat kernels was greater than weevil mortality in wheat mixed

with whole wheat meal at each dockage percentage tested (Table 1). This was expected due to the greater sorptive area of wheat meal for a given weight. Results also indicated weevel mortality decreased at a similar rate with increases in both type dockages.

Analysis of variance showed mortalities decreased significantly with fumigations in wheat of 6 per cent or more dockage compared with weevil mortality in nondockaged wheat. This data suggests that increased dosages are necessary to attain satisfactory insect control in wheat containing a minimum of 6 per cent dockage.

Further research is needed to determine the effects of all dockages on fumigant efficiency in various grains and the increase in fumigant dosage necessary to attain satisfactory insect control.

TABLE 1. Per cent mortality of adult rice weevil in Hard Red Winter wheat containing various percentages of two dockage types after fumigating 24 hours with 145 microliters of 80:20 (CCl_4:CS_2 by vol.).

% Dockage	% mortality			
	Rep. 1	Rep. 2	Rep. 3	Avg.
	Whole wheat meal[a]			
0.0	96	98	97	97.0
1.0	90	98	92	93.3
2.0	72	94	77	81.0
4.0	63	71	67	67.0
6.0	55	63	51	56.3
8.0	44	32	36	37.3
10.0	34	44	29	35.7
12.0	23	22	18	21.0
	Broken wheat kernels[b]			
0.0	96	96	98	96.7
1.0	91	89	98	92.7
2.0	81	89	97	89.0
4.0	70	76	83	76.3
6.0	57	64	73	64.7
8.0	53	47	63	54.3
10.0	30	46	52	42.7
12.0	23	36	35	31.3

[a] Sifted through a No. 20 wire screen.
[b] Sifted through a No. 0.064 x 3/8 metal sieve.

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FLEAS (Siphonaptera) OF SMALL MAMMALS IN KANSAS[1]

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Twenty-one species of fleas have been reported from Kansas by Trembley and Bishop (1940), Ackert et al. (1941), Grundmann et al. (1941), Smith et al. (1943), Graham and Ulrich (1943), Jellison (1945), Jameson (1946), Enns (1947), Hubbard (1947), Jameson (1947), Hopkins and Rothschild (1953), El Rawi (1957) and Gier and Amell (1959). No one publication reported more than eight species.

MATERIALS AND METHODS

Most small mammal hosts were collected at 14 stations of the Kansas Small Mammal Census in Anderson, Cowley, Crawford, Ellis, Finney, Johnson, Lyon, McPherson, Republic, Riley, Saline, and Shawnee counties (Gier and Bradshaw, 1957). As the catch was removed from the traps, all individuals of each mammal species were placed into a separate bag. The bags were sealed, the animals frozen and shipped to the authors for examination. Condensation moisture made parasite removal by combing impractical, so a modified flotation-recovery technique was used. One to six hosts, depending on size, were placed in wide mouth gallon jars, which were then filled with warm water and a teaspoonful of nonsudsing detergent. The jars were closed and shaken vigorously for 2 to 3 minutes, after which the ectoparasites were recovered by filtration through a 60-mesh plastic screen.

Supplemental live-trap lines were run by the senior author in Riley county during the summer of 1959, using traps similar to those described by Clayton (1952), in areas of relatively undisturbed grassland comparable to and near areas sampled in the Small Mammal Census. These animals, also, were washed rather than brushed.

Fleas were separated from the ectoparasite pools, cleared in 5 per cent KOH, and mounted from water into Hoyer's solution (Baker and Wharton, 1952). The lice, mites and ticks were stored in 70 per cent alcohol.

Officials of the University of Kansas made available for study specimens from the Snow Entomological Collection. Dr. F. G. A. M. Smit, of the British Museum, provided records of 10 species from Kansas.

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In this study, 1,023 small mammals representing 24 species were examined for fleas from November, 1958, to November, 1959. Flea collections from a few mammals collected in November, 1957, and March, 1958, were added.

RESULTS

A total of 1,783 fleas, comprising 19 species, was mounted and identified with representative verifications by Dr. Wm. L. Jellison, Rocky Mountain Laboratory, Hamilton, Montana. All records are those of the authors unless otherwise specified. Previously published records are available in Table 1.

Cediopsylla simplex (Baker). Riley Co., five from two Florida cottontails, *Sylvilagus floridanus,* and one from a red fox, *Vulpes fulva.* K.U.[4]: Miami and Anderson Cos.

Holopsyllus glacialis affinis (Baker). Riley and Kearney Cos., cottontail and jackrabbit, *Lepus californicus,* probable statewide distribution. K.U.: Anderson, Labette, and Norton Cos. Both *Cediopsylla simplex* and *H. g. affinis* occur commonly on coyotes (Gier and Ameel, 1959).

Pulex simulans (Baker). Riley Co., four, red fox, and one, opossum, *Didelphis virginianus;* Hamilton Co., seven, prairie dog, *Cynomys ludovicianus. P. simulans,* as differentiated from *P. irritans* by Smit (1958), was found to be the commonest flea on the coyote, *Canis latrans,* in Kansas (Gier and Ameel, 1959) and *P. irritans* was not found on any wild mammal. Because *P. simulans* occurred on a wide variety of wild animals and was abundant in Kansas on coyotes, foxes and other carnivores, the four specimens recorded as *P. irritans* from Kearny county by El Rawi (1957) from the jackrabbit should be considered as *P. simulans.* Also those reported by Trembley and Bishop (1940) as *P. irritans* from Reno and Riley counties were probably *P. simulans.*

Ctenocephalides felis (Bouche). Riley Co., 108, one opposum, from a garage attic in Manhattan; one, red fox, near Manhattan. K.U.: Douglas Co. Occurs on cats and dogs in Kansas.

Chaetopsylla lotoris (Stewart). Riley Co., five, grey fox, *Urocyon cinereoargenteus;* 33, 14 coyotes (Gier and Ameel, 1959). Gier (unpublished data): Riley Co., 12, raccoon, *Procyon lotor;* Clay Co., six, badger, *Taxidea taxus.*

Stenoponia americana (Baker). Riley Co., five, fall of 1957; one, fall of 1958; one, spring of 1959; and 133, fall of 1959, from several hosts. McPherson Co., five, fall of 1959; Republic Co., seven, fall of 1959. This was the predominant flea collected in Riley County in the fall of 1959, with the cotton rat, *Sigmodon hispidus,* the deer mouse, *Peromyscus maniculatus,* and the short-tailed shrew, *Blarina brevicauda,* most highly infested. All collections were from hosts found in the contiguous Kansas River Valley Subcenter faunal division (Cockrum, 1952).

Stenoponia americana had not been previously reported west of Iowa

[4] K.U.—Unpublished collection records in the Snow Entomological Museum at the University of Kansas.

Species of Fleas Collected on Various Hosts in Kansas

FLEA SPECIES	Species and Number of Hosts Examined	Didelphis virginiana–1	Blarina brevicauda–54	Cryptotis parva–12	Scalopus aquaticus–1	Lepus californicus	Sylvilagus floridanus–4	Sylvilagus aquaticus	Sciurus carolinensis	Sciurus niger–3	Cynomys ludovicianus–2	Citellus spilosoma–1	Glaucomys volans	Perognathus hispidus–1	Dipodomys ordii–114	Onychomys leucogaster–57	Reithrodontomys megalotis–34	Reithrodontomys montanus–13	Peromyscus maniculatus–249	Peromyscus leucopus–33	Sigmodon hispidus–262	Neotoma floridana–13	Neotoma micropus	Pitymys pinetorum	Microtus ochrogaster–159	Rattus norvegicus	Canis latrans	Vulpes fulva–2	Urocyon cinereoargenteus–1	Procyon lotor	Spilogale interrupta	Taxidea taxus
Cediopsylla simplex							6																				x	1				
Hoplopsyllus affinis						x	56	x																			x					
Echidnophaga gallinacea																																
Pulex simulans		1				x					7																x	4				
Ctenocephalides canis																											x	x				
Ctenocephalides felis		108																										1				
Xenopsylla cheopis																										x						
Chaetopsylla lotoris																											x		5	12		6
Stenoponia americana			38														2	4	58		12				31							
Epitedia neotomae																						x									x	
Epitedia wenmanni			4	1													1	1	43	1	16	3			6							
Rhadinopsylla fraterna			7																						1							
Corrodopsylla c. curvata			4																													
Corrodopsylla hamiltoni			x	x																												
Ctenophthalmus pseudagyrtes			14		x		x										1		3	1	x			x	19			x				
Doratopsylla blarinae																									x							
Anomiopsyllus hiemalis																							x									
Conorhinopsylla nidicola																			2			1					x					
Odontopsyllus dentatus							x																									
Monopsyllus e. kansensis															11	191																
Nosopsyllus fasciatus																									x							
Opisocrostis hirsutus											50																					
Orchopeas howardii						x			x	9			x						x	x					x		x	2				
Orchopeas leucopus			4				x							1			1	11	160	4	106			x	586		x					
Orchopeas s. pennsylvanicus																						13										
Thrassis sp.															1	3																
Thrassis campestris															5																	
Thrassis fotus												x				x																
Peromyscopsylla hesperomys											x					x																
Peromyscopsylla scotti																				3												

Numbers indicate collections of the present study.
x=other records.

except for specimens collected in Montana (Jellison, Kohls and Mills, 1943). Because of its large size, it protrudes well beyond the hair of its hosts and is thus quite conspicuous. Fifteen were recovered from a deer mouse and 27 from three short-tailed shrews. This high incidence, and large size would probably affect the health of the host. In Riley County in the fall of 1959, this flea outnumbered other species generally collected on rodent and shrew hosts and was observed to be abundant only at that time. When *S. americana* became common, other species decreased in numbers.

Twenty live adults from deer mice were brought into the laboratory on November 11, 1959, for observation. Ten eggs were observed glued in pairs to paper toweling in the cage. These eggs were light brown to tan and measured .833 to .921 mm. in width and 1.133 to 1.125 mm. in length. Although they were maintained in vials at 80 percent humidity and 70° F. for four weeks, they shriveled and failed to hatch.

Epitedia wenmanni (Rothschild). Eastern Kansas (Butler, Crawford, Cowley, Johnson, Republic, and Shawnee Cos.) and Kearney Co. British Museum: Douglas and Leavenworth Cos. K.U.: Miami Co. Collected in small numbers from several species of mice, with the deer mouse apparently the preferred host. Two, cotton rat nest; and 150, wood rat, *Neotoma floridanus,* nest, but oftener collected on cotton rats than on wood rats. An average of two fleas per host was the highest infestation from any one collection; only one or two usually were collected in pools of several hosts.

The closely related *E. neotomae* was reported (Jameson, 1946) both east and west of Riley county from wood rat nests. Jameson (1946, 1947) reported both species from Douglas Co. but did not indicate if both were collected in the same nest.

Rhadinopsylla (Rectofrontia) fraterna (Baker). Riley Co., one, prairie vole in November, 1958, and seven, nine short-tailed shrews in November, 1959; this is believed to be the largest collection reported and the first record on the short-tailed shrew. The seven on shrews were taken during the high population of *S. americana* and the apparent reduction in the usual common flea species. Jameson (1947) reported that Beamer collected *R. fraterna* from a "mouse" nest, Douglas Co.

Corrodopsylla curvata curvata (Rothschild). Riley Co., four, short-tailed shrews. Previously unreported from Kansas.

Ctenophthalmus pseudagyrtes Baker. Riley Co., 32; Republic Co., 7; and one each from Shawnee, Butler, and Pottawatomie Cos. From short-tailed shrew, harvest mouse, *Reithrodontomys megalotis,* deer mouse, prairie vole, *Microtus ochrogaster,* and a cotton rat nest. K.U.: Anderson, Douglas and Miami Cos.

The reported collection in Montana but nowhere between there and Nebraska (Rapp and Gates, 1957) indicates a peculiar distribution perhaps similar to that of *S. americana.*

Conorhinopsylla nidicola Jellison. Riley Co., three, deer mouse and wood rat; Republic Co., two, deer mouse.

Monopsyllus exilis kansensis Hubbard. Finney Co., 11 from 114 kangaroo rats, *Dipodomys ordii,* and 191 from 57 grasshopper mice, *Onychomys*

Peromyscopsylla scotti 3
Numbers indicate collections of the present study.
x=other records.

leucogaster. This subspecies was described by Hubbard (1947) from two males taken in Meade County from the grasshopper mouse. Males of the present collections fit the subspecies description. The female of the subspecies has apparently not been described.

Opisocrostis hirsutus (Baker). Hamilton Co., 50, two prairie dogs taken in summer, 1959.

Orchopeas howardii (Baker). Riley Co., two, fox squirrel, *Sciurus niger;* and two, red fox; Clay Co., seven, fox squirrel. K.U.; Douglas, Labette, Logan, Miami and Mitchell Cos.; British Museum, Leavenworth Co.

Orchopeas leucopus (Baker). Entire State (Anderson, Cowley, Crawford, Ellis, Kearney, Lyon, McPherson, Republic, Riley, Saline and Shawnee Cos.). The most abundant flea on small mammals in this study, with 886 specimens collected from eight species of hosts. Occasionally as many as 20 specimens were found on one prairie vole and 23 on one deer mouse, with 10 per host not uncommon.

On two occasions specimens frozen for 19 days were later observed active. One such collection was stored in an outdoor shelter when the temperature reached -24° F. Hence, further investigation on the ability of this species to survive is indicated because of the relationship to overwintering survival.

Orchopeas sexdentatus pennsylvanicus (Jordan). Riley Co., 13, five, wood rats; and 33, wood rat nest. K.U.: Douglas and Rawlins Cos.

Thrassis sp. Jordan. Finney Co., one, four, kangaroo rats, April 8, 1959, and three, four grasshopper mice, April 23, 1959. Dr. Jellison retained these fleas for further study.

Thrassis campestris (Prince). Finney Co., five, 10 kangaroo rats, October, 1959.

Peromyscopsylla scotti Fox. Johnson Co., three, wood mouse, *Peromyscus leucopus,* November, 1959.

The following species of fleas in the collection at the University of Kansas were not collected in this study and have not previously been reported from Kansas: *Doratopsylla blarinae* Fox, Douglas Co.; *Anomiopsyllus hiemalis* (Eads and Menzies), Barber Co.; *Odontopsyllus dentatus* (Baker), Clark Co.

Species reported in the literature but not collected in the present study were *Echidnophaga gallinacea* (Westwood), Trembley and Bishop, 1940; *Ctenocephlides canis* (Curtis), Gier and Ameel, 1959; *Xenopsylla cheopis* (Rothschild), Grundmann et al., 1941; *Epitedia neotomae* Jameson, Jameson, 1946; *Corrodopsylla hamiltoni* Traub, Jameson, 1947; and *Thrassis fotus* (Jordan), Hubbard, 1947.

All known Kansas records comprising 30 species of fleas and 31 species of small mammal hosts are given in Table 1.

Most of the common fleas exhibited little host preference. Except for a few *Orchopeas howardii* occurring with the commoner *O. leucopus* on mice, congeneric species did not parasitize the same species of host. Generally, fleas were most abundant in March and November, and infestations

were higher when host populations were declining. During a reduction in host populations, fleas apparently concentrate on the remaining animals, as noted by Frank (1953). Hence, the remaining hosts are burdened not only by the factors initially producing population declines but also with increased parasitism. The collection of 70 *O. leucopus* from three deer mice which comprised the only mammals collected in 270 trap nights, in Saline Co., illustrates this apparent concentration on remaining hosts and most certainly could be a weakening factor on such hosts.

SUMMARY

Thirty species of fleas and their known mammal hosts are recorded from Kansas. Twenty-one species had been previously reported in the literature. The present study was made on collections from 1,023 small mammals, comprising 24 species, collected from 11 counties, from November, 1957, through November, 1959.

Orchopeas leucopus was the commonest flea and was recovered from eight host species. *Epitedia wenmanni,* the common rodent flea of the eastern U. S., was found infrequently, and in eastern Kansas only. *Stenoponia americana,* here reported for the first time from Kansas, constituted the dominant species during the fall of 1959. *Monopsyllus exilis* was the dominant flea on *Onychomys. Orchopeas sexdentatus pennsylvanicus* was recovered in large numbers from nests of *Neotoma.*

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NEW AMERICAN TACHINIDAE AND SARCOPHAGIDAE (Diptera)[1]

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The new forms described below were encountered in the course of routine identification studies of materials received from various collectors, all listed under the characterizations. Unless otherwise stated, the types are provisionally retained in my collection.

Impeccantia, n. gen.

An average-size germarine fly which traces to *Masistylum*, from which it differs in the wider head, much shorter haustellum and basal antennal segment, bare prosternum, thoracic chaetotaxy, etc.

Head about one-third wider than high, frontal profile well sloped and a little longer than receding facial, antennal axis near eye middle and one-third longer than oral which is near ventral margin of head; clypeus moderately depressed; epistoma short, gently bowed forward from clypeal plane and little narrowed from same; facialia strongly divergent downward, bearing a few bristly hairs on lower fourth or less; vibrissae on oral margin, decussate; front unusually broad in both sexes, inner orbits subparallel from vertex to antennal base; two vertical and two or three pairs of proclinate orbital bristles; frontals in a single row extending two or three bristles below antennal base; ocellars and postocellars well developed, strongly proclinate and divaricate; antenna subequal to length of face, broad, compressed third segment about three times length of second; arista bare and geniculate, thickened to tip, both basal segments moderately elongate; parafacial bare, strongly narrowed downward; haustellum tapered and quite slender but not over one-half head height; labella unusually small; palpus shorter than haustellum, barely thickened distally; eye bare, not reaching to vibrissal level; cheek one-fourth eye length. Thoracic chaetotaxy: acrostichal 2, 2; dorsocentral 3, 3 or 4; humeral 3; posthumeral

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1; presutural 1 (outer); notopleural 2; pteropleural 1 (small); sternopleural 2, 1; supraalar 3; intraalar 3; postalar 2; scutellum with 2 lateral and 1 weak decussate apical pair, no differentiated discals. Wing barely reaching apex of abdomen; first posterior cell open well before wing tip; cubitulus broadly rounded, without stump or fold; third vein setulose almost to small cross vein; costal spine distinct, but not very strong. Claws and pulvilli shorter than apical tarsal segment. Abdomen long ovate; first segment without, second with one pair of weak and sometimes irregularly spaced median marginals, a marginal row on segments three and four besides a discal row on last; tips of sternites exposed.

Type: *Impeccantia claterna,* n. sp.

Impeccantia claterna, n. sp.

MALE. Head: Parafrontal, parafacial, cheek and posterior orbit silvery, occiput cinereous; front at vertex 0.53 of head width and but slightly wider at antennal base; red frontalia about one-half or more parafrontal width at mid front level, cleft above and extending to vertex on either side of ocellar plate; parafrontal beset with a few scattered short black hairs; proximal antennal segments orange yellow and contrasting sharply with black third segment, which measures about one-third as wide as long and is broadly rounded on apex; palpus yellow; bare arista shorter than antenna, second segment one-third to three-fourths length of third, basal segment three or four times longer than wide; vibrissae on oral margin; slender haustellum plus labella barely equal eye length.

Thorax black dusted with rather heavy gray pollen marked above with changeable dark vittae which become indistinct behind suture; scutellum black, gray pollinose. Legs shiny black, mid tibia with two anterolateral and fore tibia with two posterolateral bristles; pulvilli minute, claws less than half as long as apical tarsal segment. Wing clear, veins yellow to brownish; epaulet black; hind cross vein midway from cubitulus to small cross vein; last section of fifth vein two-fifths length of preceding; calypters opaque white.

Abdomen red infuscated along median line above including hind margin of third segment and entire upper surface of fourth, basal half to three-fifths of segments two to four lightly dusted with gray pollen; hypopygium small, retracted within tip of anal segment; forceps short, tapering from a flat moderately broad base to a very slender or delicate beaklike apical half; accessory process as long as forceps but much stouter; penis recurved shortly before apex and terminating in a reflexed pale membranous vase-like tip; anterior clasper broadish on basal half thence bowed forward and narrowed to an acute tip; posterior clasper about as slender as forceps.

FEMALE. Similar to male but a little heavier in build; abdomen lacking a dark median vitta; antenna orange yellow, third segment infuscated beyond middle on outer side and along inner apical extremity.

Length, 7-9 mm.

Holotype male: Douglas, Cochise Co., Arizona, August 4, 1958 (D. D.

Linsdale). Allotype female: Wilcox, Arizona, August 11, 1928 without collector's label. Paratype: 1 male, Roswell, New Mexico, July 22, 1952.

Uramya hariola, n. sp.

Traces to *U. quadrimaculata* Macquart in available keys but differing from all other known forms assigned here in having the calypters deeply infuscated. Additional differences are listed below.

MALE. Head pollen pale satiny yellow obscuring dark ground color except at vibrissal angles; front greatly narrowed before ocelli, with black frontalia pinched out and frontal bristles stopping at narrowest point; eye thickly pilose; cheek one-half eye length clothed with long fine to bristly black hairs; antenna largely black, third segment rather slender, over three times length of second; black pubescent arista longer than normal and evenly tapered from base to middle; palpus long and slender, brown basally becoming paler or reddish apically.

Thorax black dusted with pale yellowish gray pollen, marked with four narrow velvety black mesonotal vittae which become obsolete far before base of scutellum; latter black, without defined discals. Legs long but not very slender, mid tibia with three anterodorsal bristles, middle one subequal to one-half tibial length; claws and pulvilli elongated. Wing yellowish costobasally, thence infuscated especially along principal veins becoming paler or gray hyaline along hind margin; veins yellow to brown, third with four to five setae near base.

Abdomen black, wider than thorax and narrowed apically to a subtruncate tip; intermediate segments each with a sharply defined laterobasal area of pale yellow pollen and bearing three pairs of discals; one pair of median marginals on segments one and two and a marginal row on third, anal segment strongly bristled above except on basal margin; genitalia caudoventral, fifth sternite deeply incised, lobes black, widely exposed and clothed with a thin vestiture of fine black hairs. Female not known.

Length, 15 mm.

Holotype: Colombia, South America, without precise locality or other pertinent data.

Acronarista adunata, n. sp.

MALE. Differs from the genotype, *A. mirabilis* Tns., in having the arista located nearer to the middle of the third antennal segment and in having the abdomen much more extensively pollinose above. Head wholly cinereous pollinose on black ground color, with frontalia paler or reddish; front wide, vertex 0.28 of head width; two pairs of proclinate orbitals and outer verticals developed; ocellars small but distinct; frontals in a single row, one bristle below antennal base; bare parafacial greatly narrowed or linear below; clypeus large and barely depressed, facialia flattened and nearly in clypeal plane, setose on lower fourth; vibrissae set slightly below oral margin; antenna subequal length of face, black becoming reddish basally, third segment compressed and excised from apex to basal fourth forming two bowed rami which are well separated in the form of an inverted U; bare geniculate arista very short, reaching a little beyond apex of dorsal ramus,

second segment slightly elongate; eye bare; proboscis short, labella fleshy; occiput sparsely black-haired.

Thorax and scutellum cinereous, notum nonvittate. Chaetotaxy: acrostichal 3, 3; dorsocentral 3, 4; presutural 2; notopleural 2; humeral 3; sternopleural 3; pteropleural 1 (small); scutellum with 4 lateral (intermediate bristles small); 1 apical and 2 pairs of appressed discal bristles. Legs black, mid tibia with one anterodorsal bristle; claws and pulvilli small. Wing clear tinged with yellow basally; third vein with two hairs near base; last section of fifth vein about one-half length of preceding; first posterior cell closed near extreme wing tip; costal spine minute; calypters white.

Abdomen black, last three segments above dusted with gray pollen, which in a flat rear view extends to hind margin of each and shows a well defined dark median vitta on segments two and three; latter with one pair of median marginals, anal segment with a discal and marginal row; hypopygium black, small and retracted. FEMALE not known.

Length 3.5 mm.

Holotype: Tehucana, Puebla, Mexico, June 23, 1951 (P. D. Hurd) in the California Academy of Sciences collection.

Thematheca, n. gen.

Allied to *Viviania* (type, *cinerea* BB.) but head nearly one-third wider than high, ocellars and outer verticals absent, abdomen without discals on declivous anal segment, etc.

FEMALE only. Frontal profile subequal to receding facial, antennal axis near eye middle and about one-fourth longer than oral; clypeus moderately sunk, slightly raised on median line and barely narrowed upward, full width epistoma gently bowed forward from clypeal plane; vibrissae far above oral margin; facialia rounded with a cluster of short bristles on each oblique angle immediately above vibrissae; bare, equibroad parafacial about three-fourths clypeal width; eye bare, reaching vibrissal level; proboscis short, labella fleshy; palpus subequal length of haustellum. Thoracic chaetotaxy: acrostichal 3 (hindmost near suture), 3 or 4; dorsocentral 3, 4; intrapostalar and intrapostsutural well developed; intraalar 3; supraalar 3; presutural 2; notopleural 2; humeral 3-4; sternopleural 2, 1; pteropleural 1-2 (small); scutellum fringed with 8 marginal bristles all parallel and equal in length, including 3 lateral (sometimes a shorter bristle between two basal ones), 1 apical and 1 smaller but well differentiated discal pair; postnotal slope and prosternum setose, propleuron bare. Wing extending well beyond apex of abdomen; first posterior cell open well before wing tip; costal spine vestigial; hind lobe of calypter longer than broad. Abdomen narrower than thorax, strongly arched, declivous anal segment truncate apically with large rounded anal orifice; genitalia very distinctive in structure, apical segment sclerotized and partially exerted, terminating in a scoop-shaped apex not adapted for piercing.

Type: *Thematheca medeola,* n. sp.

Thematheca medeola, n. sp.

FEMALE. Head pollen yellow to golden becoming grayish on lower half of cheek and entire occiput; vertex 0.28 of head width, front gradually widening to antennal base; frontalia velvety brown, much wider than parafrontal on entire length; verticals one (inner) pair; two proclinate orbitals; frontals smaller than average, two or three pairs diverging below antennal base; antenna extending a little below mid face, basal segments rufous, second one-half to three-fifths length of darker third segment; arista black, bare, slightly thickened and tapered near base, slender beyond, both basal segments short; palpus red, bowed and moderately thickened apically; cheek finely black-haired, about one-third eye length; occiput flat, two rows of black hairs on upper margin and wholly pale pilose below.

Thorax and scutellum black, grayish pollinose, mesonotum with four broad black vittae and a narrower median one behind suture. Wing gray hyaline, veins reddish to brown, third with three or four setulae near base; sinuate hind cross vein less than its length from cubitulus, latter obtusely rounded, without appendage. Legs subshiny black, stoutish but normal in length; hind tibia subciliate, middle one normally with two anterolateral bristles; claws approximating length of fifth tarsal segment, pulvilli slightly shorter.

Abdomen largely black, last three segments with moderately heavy yellow pollen on upper surface becoming golden and much denser obscuring reddish ground color of anal segment, which like the preceding lacks discals.

Length, 9-11 mm.

Holotype: Rio Tehuantepec, Oaxaca, Mexico, September 6, 1947 (F. A. Cowan, M. R. Wheeler). Paratypes: 2 females, Cuernavaca, Morelos, Mexico, August 12, 1941 and 1 female, Chiricahua Mts., Arizona, August 8, 1955 (G. D. Butler).

Lispideosoma triste, n. sp.

Similar to the genotype, *L. flavipes* Rnh., but at once distinguished by wholly black antennae, vittate thorax, black femora and tarsi, etc.

MALE only. Parafrontal black, contrasting sharply with reddish yellow frontalia, latter over twice width of former; front broad, vertex over one-third head width; outer verticals developed, two weak proclinate orbitals and a single row of frontals extending one or two bristles beneath antennal base; ocellars small, widely divaricate; entire face including cheek and lower part of occiput whitish pollinose on pale background; parafacial equal to width of facialia inverted and bearing a median row of micro setae on its entire length; cheek about two-fifths eye length, black-haired before middle and pale pilose behind; vibrissae on level with protuberant oral margin; haustellum about two-thirds head height; palpus yellow, slender with apex moderately thickened; antennae reaching to lower fourth of face, third segment uncommonly broad and four times longer than second; bare black geniculate arista thickened almost to tip, second segment subequal to length of third, first segment short or about as wide as long; eye bare, reaching nearly to vibrissal level.

Thorax and scutellum black dusted with gray pollen, notum marked with four narrow black vittae interrupted at suture. Chaetotaxy: acrostichal 3, 3; dorsocentral 3, 3; sternopleural 2, 1; humeral 2; presutural 1 (outer); pteropleural 1 (small); scutellum with 3 lateral bristles, discals and apicals not developed; prosternum bristled; postnotal slope bare. Legs black; coxae, trochanters and tibiae reddish; claws and pulvilli short. Wing subhyaline with a light uniform smoky tinge; first posterior cell narrowly open slightly before wing tip; cubitulus obtusely rounded, without fold or stump; third vein with two bristly hairs near base; costal spine small; calypters tawny, semitranslucent.

Abodmen black, all segments gray pollinose above with median line and narrow hind margin of each appearing darker or blackish in a flat rear view; one pair of median marginals on second segment and a marginal row on each of the two following ones; genital forceps short, subcarinate behind about to middle, thence suddenly reduced and slender or beaklike to apex; sternites covered.

Length, 6 mm.

Holotype: West Slope of Cortez Pass, Mexico, Mexico, 10,000 ft., August 11, 1954 (R. R. Dreisbach).

Eugaediopsis rubentis, n. sp.

Similar to the type species *E. setosa* (Coq.) but with abdomen and legs predominantly red in ground color, proximal antennal segments bright reddish yellow, abdominal pollen unicolorous, etc.

MALE. Head pollen silvery on face and cheeks becoming brassy on front, which measures 0.34 of head width at vertex; verticals two pairs, ocellars absent, frontal rows doubled on widest part of front; parafacial with a median row of stoutish bristles and a vestiture of black hairs between latter and eye margin extending from lowest frontals to cheek groove; third antennal segment black, slightly over twice length of second; bare, black arista thickened to middle or slightly beyond, basal segment short, second elongated; facialia rounded, with strong but rather widely spaced bristles extending a little above middle; cheek one-third or more eye length; palpus yellow, subequal to haustellum length.

Thorax largely reddish in ground color, scutellum entirely so, four notal vittae before suture and five behind. Chaetotaxy: humeral 4; notopleural 3; presutural 2; supraalar 3; intraalar 3; dorsocentral 3, 4; acrostichal 3, 3; sternopleural 4; pteropleural 1-2 (smaller than sternopleural); scutellum with 3 lateral, 1 appressed discal and 1 moderately strong upturned apical pair. Mid tibia with two or three anterodorsal bristles, hind tibia subciliate with one stout bristle near middle of row; tarsi blackish, claws and pulvilli longer than last segment. Wing gray hyaline lightly tinged with yellow costobasally; first posterior cell open far before wing tip; cubitulus rounded, without stump or fold; hind cross vein oblique, in plane of apical; third vein with two or three setulae near base; costal spine minute; calypters opaque white, outer rim tinged with yellow.

Abdomen red with a well defined black median vitta extending from

base to tip, entire upper surface dusted with thin whitish pollen; one pair of median marginals on first two and a marginal row on last two segments besides a discal row on anal; genital forceps stoutish, keeled behind and tapering apically to separated bluntly rounded polished tips; accessory process as wide as but much shorter than forceps, finely haired on outer side apically; fifth sternite with a deep narrow incision, lobes blackish and sparsely haired.

FEMALE. Vertex 0.35 of head width; two strong verticals and proclinate orbitals; second antennal segment two-fifths length of third; claws and pulvilli small; abdomen shorter and broader, anal orifice slitlike, genitalia wholly retracted.

Length, 10-10.5 mm.

Holotype male and allotype female: Chiricahua Mts., Arizona, July 30, 1957 (G. D. Butler). Paratypes: two males and 1 female same data as type; 4 males, S. Fresnillo, Zacatecas, Mexico, August 20, 1956 (D. D. Linsdale) and 1 female, Cuernavaca, Morelos, Mexico, August 21, 1936, without collector's label.

Eugaediopsis vinnula, n. sp.

Differs from the preceding species chiefly as follows: front subgolden, face and cheeks considerably paler, thorax and legs predominantly black, abdomen orange yellow on sides and venter, anal segment with heavy golden pollen which becomes thinner and grayish on preceding segments; parafacial with a barely differentiated median row of weak bristly hairs and black setose outside of latter; proximal antennal segments reddish black, third nearly four times length of second; intermediate abdominal segments each with a pair of short but distinct discals; wing grayish hyaline. FEMALE unknown.

Length, 11 mm.

Holotype male: Sunnyside Canyon, Huachuca Mts., Arizona, July 9, 1940.

Ignotomyia, n. gen.

With the habitus of *Promasiphya,* type *Masiphya confusa* Aldrich, but at once distinguished by the total absence of palpi and the female genitalia without a piercer.

Head a little wider than high, antennal axis near eye middle and subequal to length of oral, arcuate frontal profile one-fourth longer than slightly receding facial; clypeus hardly at all depressed; full width and transversely arched epistoma subnasutely produced from clypeal plane; long decussate vibrissae far above oral margin; facialia with two or three bristly hairs on lower extremity; parafacialia bare, slightly narrowed below; large, bare eye reaching well below vibrissal level; cheek about one-fifth eye length; verticals two pairs, outer one weak but differentiated in male, inner stoutish and erect; two strong proclinate orbitals in female and two large reclinate preverticals and good-sized proclinate ocellars in both sexes, frontals in a single row with one or two bristles beneath antennal base; antenna rather

slender but reaching barely three-fourths the distance to vibrissae, third segment about twice length of second; arista bare, proximal segments short; proboscis slender, but well under head height. Thoracic chaetotaxy: humeral 4-5; posthumeral 2; presutural 2; notopleural 2; sternopleural 2, 1; pteropleural 1 (smaller than sternopleural); supraalar 3; intraalar 3; dorsocentral 3, 3; acrostichal 3, 3; postalar 3; intrapostalar well developed; scutellum with 2 strong lateral and 1 smaller decussate apical pair, no differentiated discals; postnotal slope and propleuron bare; prosternum haired at sides with a pair of well differentiated bristles. Wing ordinary in size and shape, third vein setulose nearly halfway to small cross vein; first posterior cell open far before wing tip; costal spine vestigial. Abdomen as wide as thorax, narrowed to tip in male but apex narrowly truncate in female; one pair of widely separated median marginals on segments one and two, a complete and much stouter marginal row on three and four; venter of male anal segment bearing a dense patch of bristly hairs on either side of middle beset with pale pile and defined patches of dense black bristles; female genitalia terminating in a blunt-tipped organ retracted within tip of abdomen.

Type: *Ignotomyia cunina,* n. sp.

Ignotomyia cunina, n. sp.

MALE. Head pollen pale gray to silvery lightly tinged with yellow on parafrontal, latter with a sparse vestiture of fine hairs on upper half and bare below; frontalia deep brown, barely equal to one-half parafrontal width; vertex 0.27 of head width, front equibroad about to middle thence widening into facial angle; antenna largely reddish, third segment usually infuscated on apical half; arista black, thickened and tapered on basal fourth, very slender from middle to delicate tip; cheek entirely pale-haired; haustellum sparsely setose, slightly tapered and approximating two-thirds eye length; occiput with a dense vestiture of whitish hairs.

Thorax gray pollinose on black background, dorsal vittae well defined, four before suture and five behind; scutellum black, dusted with changeable gray pollen, hindmost lateral bristle reaching to base of third abdominal segment. Legs shiny black; hind tibia subciliate with several longer bristles in row, mid tibia with two median anterolateral bristles; claws and pulvilli strongly elongated. Wing subhyaline, hind cross vein strongly oblique, about two-thirds its length from cubitulus, latter without stump or fold; epaulet and subepaulet jet black, calypters opaque white, hind lobe obliquely transverse.

Abdomen black with red apex, entire upper surface of last three segments sprinkled with bluish white pollen; hypopygium caudoventral, small and retracted in repose; fused forceps long triangular in rear view, moderately thick in profile, apex obliquely truncate with posterior extremity rounded and produced as a minute anterior hook; accessory process broad and platelike, beset with a few long hairs near apical margin; penis gradually widened from base to a divided or Y-shaped apex, each arm of latter terminating in a slightly expanded or vaselike tip, on the hind side a pale

membrane extends forward beyond the base of the two divergent apical processes; fifth sternite deeply cleft, lobes small beset with black hairs on inner margin.

FEMALE. Front at vertex 0.33 of head width and hardly widening forward to antennal base; hind tibia not ciliated, claws and pulvilli minute; abdomen entirely black; otherwise similar to male.

Length, 7-9.5 mm.

Holotype male: Portal, Chiricahua Mts., Arizona, August 22, 1958 (D. D. Linsdale). Allotype female: Carrizo, Arizona, July 24, 1956 (Butler-Gerhardt). Paratypes: 2 males, same data as holotype; 1 male and 1 female, Molino Camp, Santa Catalina Mts., Arizona, June 22, 1953 (R. S. Beal) and 1 male, Portal, Arizona, June 22, 1956 (O. L. Cartwright) in the U. S. National Museum.

Phrosinella talpina, n. sp.

Very similar to *P. pilosifrons* Allen, from which it differs principally in having the apical segments of the male fore tarsus distinctly longer, fourth barely narrower than preceding or third segment; also, the fringe of hairs on the second segment obviously shorter and denser and extending from the inner ventral to the upper outer margin of the segment.

MALE. Pollen silvery on parafacial, less so and thinner on frontal orbit which appears blackish and bears numerous longish erect black hairs above middle; vertex 0.43 of head width, narrowed to 0.36 of same at antennal base, lunule setose; equibroad frontalia pollinose and over two times parafrontal width at mid front level; parafacial black-haired from lowest frontal to cheek groove; facialia bearing weak bristly hairs on lowest fourth or less; cheek about one-sixth eye length; palpus yellow; antenna subequal to length of face, black third segment nearly six times longer than second; arista bare, thickened to or beyond apical fourth; occiput flat, plumbeous, thinly clothed with short black hairs.

Thorax black, thinly gray pollinose, notal vittae scarcely visible in any view; acrostichals absent before suture, three post dorsocentrals, two sternopleurals and three marginal scutellars of which the hindmost are decussate. Legs black, mid and hind tarsi normally developed; claws and pulvilli short. Wing hyaline, veins brown, third setulose halfway to small cross vein; costal spine subequal to length of small cross vein; calypters translucent white.

Abdomen black, broad hind margin of last three segments polished, with pale basal pollinose bands which are narrowed from behind by shiny median and submedian tridental spots; a pair of median marginals on first segment, two pairs on second and a complete marginal row on last two segments; no discals; hypopygium caudoventral, small and retracted within tip of abdomen. FEMALE unknown.

Length, 7-8 mm.

Holotype: San Diego Co., California, IV-9-36. Paratype, 1 male, same data as type and 2 males, Lassen Natl. Pk., Shasta Co., California, August 20, 1958 (R. F. Wilkey).

Metopia lucipeda, n. sp.

Traces to *M. campestris* in most available keys but with parafrontals shiny black and much more densely haired above middle; first abdominal segment with two pairs of median marginals, etc.

MALE. Front at vertex 0.42 of head width, narrowed forward to 0.28 of same at lunule, which is setose; black nearly equibroad frontalia over twice parafrontal width at mid front level; two pairs of verticals and proclinate orbitals; frontals in a single row, two bristles beneath antennal base; ocellar plate with a dense vestiture of erect hairs and a pair of long proclinate bristles; antenna as long as face, wholly black, third segment about seven times length of second; bare black arista thickened on basal third or less; silvery, narrow parafacial with a row of closely set infraclinate bristles extending along inner edge from near aristal level to cheek groove; palpus black, subequal to length of haustellum; cheek sublinear, about one-eleventh eye length; occiput beset with rather short black bristly hairs.

Thorax and scutellum feebly shining black, lightly dusted with gray pollen, dorsal vittae poorly defined. Chaetotaxy: acrostichal 2, 3; dorsocentral 2, 3; intraalar 2; supraalar 3; notopleural 2; presutural 1 (outer); post humeral 2; humeral 2; pteropleural 0; sternopleural 2; scutellum with 2 lateral, 1 decussate apical, no discals; postscutellum recessive. Legs black, moderately long and slender; mid tibia with one anterolateral bristle; claws and pulvilli short. Wing gray hyaline; veins brown, third setose halfway to small cross vein; hind cross vein its length from rectangular cubitulus which bears a distinct fold; first posterior cell open far before wing tip; costal spine vestigial; calypters opaque white tinged with yellow.

Abdomen ovate, wider than thorax, black with gray pollen above extending well beyond middle of last three segments except along median line; a marginal row of bristles on each of last three segments but incomplete on second; no discals; hypopygium small, caudoventral; fused genital forceps keeled behind and tapering to near middle, thence beaklike to tip. FEMALE unknown.

Length, 7.5 mm.

Holotype: Leland Meadow, Toulumne Co., California, July 1, 1957 (A. E. Pritchard). Paratypes: 1 male, same data as type and 1 male, San Antonio Valley, Santa Clara Co., Calif., August 18, 1949 (J. E. Gillaspy).

NOTES ON *NEMOTELUS* (Diptera: Stratiomyidae)[1]

W. J. HANSON

It has been pointed out by Dr. Willis W. Wirth (personal communication) that the name *Nemotelinus,* proposed by Enderlein in 1936 as a new genus, with *Nemotelus nigrinus* Fallén as type species, has priority over *Melanonemotelus,* the name I used and attributed to Lindner in my revision of this group. The name *Melanonemotelus* first appears in a subgeneric key in Lindner's *Die Fliegen der Palaearktischen Region* (1937), and although one species of the subgenus *(nigrinus)* is included in the work, there is no reference to it in the key, nor is there any statement in the discussion of the species that it belongs to that subgenus. *Melanonemotelus* was thus proposed without included species in Lindner's work and was therefore not available. *Nemotelinus* Enderlein 1936 is the correct name for the subgenus, with *Melanonemotelus* Hanson 1958 now placed in synonymy with it.

Since my revision of this subgenus, additional specimens have been received, with the result that the known ranges of certain species are greatly extended. These are as follows.

Nemotelus (Nemotelinus) glaber Loew

Known previously from New York and the Midwest, southwestward into Mexico. FLORIDA: Alachua County (March); Duval County, Jacksonville (May). PANAMA: Cerro Campana, 60 km. west of Panama City (April).

Nemotelus (Nemotelinus) jamesi Hanson

A western species collected at a few widely scattered localities. CALIFORNIA: Inyo County, Goodale Cr. north of Lone Pine (April). OREGON: Umatilla County, Umatilla (May).

Nemotelus (Nemotelinus) politus Hanson

Known previously from southeastern Washington and western Wyoming, southward into southern California. COLORADO: Huerfano County, Walsenburg (June); Larimer County, Ft. Collins (July); Weld County, Greeley (August) and Roggen (July). These specimens differ from typical *politus* in having much smaller frontal spots. OREGON: Klamath County, Klamath Falls, Lower Klamath Lake, mouth of Williamson River (June-August).

Nemotelus (Nemotelinus) tenuistylus Hanson

MEXICO: Baja California, Amortajada Bay, Isla San José (March). First record for Mexico.

Thanks are extended to Mr. P. H. Arnaud, Dr. M. T. James and Dr. H. V. Weems for the loan of specimens and to Dr. Wirth for calling to my attention the subgeneric synonymy.

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